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# THE COMMENTARIES UPON THE APHORISMS OF Dr. HERMAN BOERHAAVE,

The late Learned Profeſſor of Phyſic in the
Univerſity of LEYDEN.

CONCERNING

The KNOWLEDGE and CURE of the ſeveral
DISEASES incident to HUMAN BODIES.

By GERARD VAN SWIETEN, M. D.

Tranſlated into ENGLISH.

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# THE

# PREFACE.

TO attempt an encomium on Dr. Boërhaave, or his Aphoriſms, might be deſervedly eſteemed an unprofitable labour, as the reputation both of the author and his performance is at preſent ſo well eſtabliſhed, that their fame may be juſtly ſaid to have extended already to the utmoſt corners of the earth.

This production was firſt ſent abroad in Latin, at Leyden, in 1708, about ſeven years after Dr. Boërhaave had officiated as Lecturer in the univerſity, and the year before his advancement to the Profeſſor's chair. It has ſince bore four impreſſions in its original, and been tranſlated into the moſt conſiderable of the modern languages, into Engliſh, French, and Arabick, being one of the firſt books, that by order of the Mufti was printed at Conſtantinople in the new erected preſs, which not many years ago was ſet up there by the authority of the Grand Vizir.

It was preceded in 1707, by our author's *Inſtitutiones Medicæ*, and bears this relation to it, that as the former comprehended the theory, ſo this latter takes in the whole practice of phyſick. Dr. Boërhaave's deſign in both, was to furniſh his pupils with a ſummary of the ſeveral ſubjects, whereon he propoſed to diſcourſe more at large in the lectures he intended to give them.

And as every man has his particular way of thinking, and muſt of neceſſity be ſuppoſed to underſtand his own meaning better than another's, he the rather choſe, as himſelf informs us *, to comment upon a work drawn up by himſelf, than to explain the writings of any other perſon, how eminent ſoever, as by this means he could not but expreſs himſelf with the greater accuracy, and of conſequence convey his ſentiments with the greater eaſe and advantage into the minds of his hearers.

In compiling this work he has taken a great deal of pains to be as conciſe as poſſible; and, yet ſhort as the whole is, we have here joined to the correct obſervations of the Greeks, whatever has been found to be uſeful among the Arabians, with the improvements of the Moderns ſuperadded to both. From this conciſeneſs however his performance has been cenſured as obſcure. And indeed this circumſtance ſeems to have been unavoidable from the nature of the work. For how was it poſſible, that ſo many and ſuch important ſubjects ſhould be included within ſo narrow a compaſs, and not be obſcure? Beſides, as Dr. Boërhaave only deſigned it for the text of his lectures, it ſeems as if he intended, that his explications ſhould be neceſſary to make it well underſtood, eſpecially by ſuch, as were not already converſant in the art. For this reaſon his Commentaries have been greedily ſought after, and even indirect methods taken to have them made publick.

About fifteen years ago there was printed at Amſterdam, under the name of Padua, a book entituled

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* Præfat. ad Inſtitut. Medic.

entituled *Praxis Medica, ſive Commentarius in Aphoriſmos de cognoſcendis & curandis morbis,* in five Volumes in 8vo. This was given out to contain the entire *dictata* of Dr. Boërhaave on his Aphoriſms, as taken down from his own mouth by one of his ſcholars, who attended upon his private lectures. But whoever the writer was, this ſurreptitious performance, as we learn * from a good judge in this matter, was ſent abroad "ſo ſcandalouſly incorrect, as "if the editor had neither underſtood the ſub-"ject nor the language, nor intended benefit "to any except the proprietors of that edition." Its defects, however, have been ſince ſupplied by the induſtry of Dr. Van Swieten, who, to prevent the like impoſition upon the publick for the future, and at the ſame time to do juſtice to the memory of the learned compiler, has lately given us an accurate edition of part of this work, which he intends to compleat; and it is the fruit of his labours, that in the following ſheets we have attempted to lay before the Engliſh reader.

This gentleman, who is now a Phyſician of great note at Leyden, and has long diſcharged the office of lecturer in pharmacy to the Engliſh ſtudents, was for near twenty years an auditor of Dr. Boërhaave, and, perhaps, the only one that was ſo, was admitted to a large ſhare of his private converſation and friendſhip, and allowed to conſult him with freedom upon every difficulty that occurred in any of his lectures. Theſe were advantages in a manner peculiar to himſelf, and ſuch as more particularly qualified him for ſucceſs in this great undertaking. Nor does he ſeem to have declined any opportunity that could offer, whereby he might reflect honour to his maſter, or contribute to the benefit of his reader. It was Dr. Boërhaave's cuſtom to confine the explanation of his Aphoriſms to the ſhort limits of a ſingle year, and as he was very careful to inculcate the firſt principles of the ſcience he was teaching into the underſtandings of his pupils, he found himſelf ſometimes obliged to make a repetition of what he had before advanced, in favour of ſuch of them, as were of a meaner capacity than the reſt. By this means it frequently happened, that through want of time he was forced at the cloſe of the year to cut ſhort his diſcourſe, and explain the laſt-handled ſubjects in a more haſty manner than agreed well with his own inclinations. This inconvenience he endeavoured in ſome meaſure to redreſs by his publick lectures, wherein he choſe to dwell more largely upon the reſpective points, whereon he had touched but ſlightly in his private inſtructions. For the truth of this Dr. Van Swieten * appeals to the teſtimony of ſuch of his hearers, as were preſent with him at the lectures he gave in publick concerning the *ſtone*, the *venereal diſeaſe*, the *nerves* and *nervous diſorders*, and concerning the *heart*. That the reader, however, might be deprived of no advantage, the ſubſtance both of theſe publick lectures, ſo far as they could be adapted to the explication of the Aphoriſms, as alſo of his private inſtructions, is inſerted by the Doctor in theſe commentaries. He has farther added, whatever his own great judgment or experience could ſuggeſt to him, as uſeful upon this occaſion, and has alſo interwoven the ſeveral paſſages, which from time to time he had collected from the moſt eminent, and more eſpecially the antient, Phyſicians, for his own private benefit. From this laſt circumſtance the reader will plainly diſcern, how nearly the reaſonings and obſervations of Dr. Boërhaave have been allied to thoſe ſentiments of Hippocrates and Galen, which have already ſtood the teſt of ſo many ages, and will ſtill continue to be approved of, whilſt human nature ſhall itſelf ſubſiſt.

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* Life of Dr. Boërhaave, &c. pag. 118.

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* Præfat. ad hunc Commentar.

From the uſefulneſs therefore of this undertaking, we hope, that an Engliſh edition of it will be received by all, as an acceptable ſervice done to the publick. The practice of Phyſick, as it now ſtands in England, is by no means confined to men of learning only: and we judge, that it cannot but be of benefit to mankind in general, that all, who are entruſted with the care of life and health, ſhould be directed to a right way of thinking in the beſt manner that is poſſible.

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# COMMENTARIES
# UPON THE
# APHORISMS
# OF
# HERMAN BOËRHAAVE,
# CONCERNING THE
# KNOWLEDGE and CURE of DISEASES.

## INTRODUCTION.

### SECT. I.

EVERY ſtate of the human body, which is injurious to the vital, natural, or even animal functions, is named a Diſeaſe.

We have here given us the perfect definition of a diſeaſe, a point neceſſary to be premiſed, before any thing certain can be eſtabliſhed concerning the cure of diſeaſes. When the body is found to decline from health, all men ſay it labours under a diſeaſe; but as Galen (a) has well obſerved, we uſe this word *health* with ſome degree of latitude, *Non enim abſoluta ipſa eſt, nec indiviſibilis ſimul, quæ eſt & dicitur ſanitas, verum etiam quæ ab hâc deficit, modo adhuc uſibus noſtris non ſit inepta*; "Health, whether real or reputed," ſays

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(a) De ſanitate tuenda, Lib. I. cap. 5. Charter. Tom. VI. pag. 45.

he, “ is not abſolute and indiviſible, but we give this “ name to ſuch a degree of it, as renders a man capable of going about his buſineſs.”

It would perhaps be a very difficult taſk to find a man perfectly in health, in whom there was nothing amiſs either in the ſolids, the fluids, or in the motion of the fluids through the ſolid canals; for we undergo ſo many alterations every day, from the change of the air which ſurrounds us, the affections of the mind, the greater tenacity or larger quantity of the food we take down, *&c.* that we cannot but in a looſer ſignification be ſaid to be in health; and for this reaſon I apprehend Galen *(b)* has defined health in this ſenſe; *perfecte ſanus nemo dici poteſt, ſed ſani dicuntur, qui nulla corporis parte dolent, & ad vitæ munera haudquaquam ſunt impediti*; “ No perſon can, properly ſpeak- “ ing, be ſaid to be perfectly in health, but we uſu- “ ally ſay ſuch perſons are in health as have no par- “ ticular complaint, and are able to diſcharge the “ common offices of life.”

Now health injured is diſeaſe. But for the greater regularity of enquiring into diſeaſes, Phyſicians have reduced the functions of an healthful body into three kinds, which they have named vital, natural, and animal. Thoſe functions are named vital, which are abſolutely neceſſary to life, and without which there is no life. For both ſolids and fluids may certainly ſubſiſt unaltered both in quality and quantity, and yet there may be no life; thus when a man is drowned, the body receives neither diminution nor acceſſion, only motion is wanting, and if this could be reſtored, life would return.

How juſt an image of death do we find in a man, who has fallen into a ſyncope? Throw cold water upon him, and the veins will contract, and drive the blood towards the heart, which being thus irritated will contract likewiſe, and the man revive.

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(b) De ſanitate tuenda, Lib. VI. cap. 5. Charter. Tom. VI. p. 170. & de morb. differentiis, cap. 1. Charter. Tom. VII. p. 1.

Perfect life is health, the abolition of life is death, and life injured is diſeaſe.

Since the diſcovery of the circulation of the blood, it is plain to a demonſtration, that the loweſt degree of life ſtill requires the contraction and dilatation of the heart; but theſe cannot ſubſiſt, unleſs there alſo remains the muſcular motion of the heart, the influx of the venal blood into the cavity of the heart, and the expulſion of the arterial blood from the cavity of the heart.

But there can be no muſcular motion of the heart, without the free action of the cerebellum and the nerves which are diſtributed from thence to the heart, and the impulſe of the arterial blood through the coronary arteries.

Nor can the venal blood flow into the heart, without the return of the blood into ſome of the veins at leaſt.

And after a man is once brought into the world, the blood muſt have a free paſſage through the lungs, before it can paſs from the right ventricle of the heart into the left.

The Ancients made the vital functions two-fold, and called by this the name pulſe and reſpiration; but the vital functions ſeem to be all thoſe conditions, without which life cannot ſubſiſt; and the pulſe and reſpiration are the external ſigns of life.

For this reaſon vital diſeaſes are all thoſe, which hinder the influx of the venal blood into the cavities of the heart, and the expulſion of the arterial blood from the cavity of the heart, as appears from a proper enquiry into every different kind of death.

And hence we ſee the truth of that ſaying of Hippocrates (c) in the beginning of his book *De locis in homine*; *Principium corporis mihi quidem nullum eſſe videtur, ſed partes omnes peræque principium, omneſque finis. Deſcripto namque circulo, principium non invenitur;*

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(c) Charter. Tom. VIII. p. 357.

*nitur*; "That no part of the body can properly be "called the firſt, but that each particular part is alike "the firſt and the laſt; as when you have drawn a "circle, you cannot tell where it was begun."

To the action of the heart is certainly required the action of the cerebellum upon the heart by the nerves; nor can the cerebellum act, ſecrete the animal ſpirits, or carry them ſo ſecreted through the nerves, without the action of the heart impelling the blood through the arteries of the cerebellum; and ſo of all the reſt.

And thus the heart acts, ſo far as it has the cauſes of its motion common with other muſcles; but there is this wonderful property in the heart, that, independent of theſe, it is capable of continuing its motion for a conſiderable time.

For which reaſon the Antients ſuppoſed there was a latent vital principle reſiding in the heart; and Galen has ſaid, that motion was innate to it.

Nor will this ſeem abſurd to any perſon who conſiders, that though the heart be furniſhed with the common cauſes of muſcular motion derived from the arteries and nerves, it farther contains within itſelf a power of raiſing motions, which cannot be deduced from the ſtructure of the parts, that we are hitherto acquainted with.

For cut off all the veſſels from the heart, and the heart will continue its motion, and for a conſiderable time too; thus the heart of an eel taken out from the body continued to beat, and though put under a receiver, and the air exhauſted, its *(d)* pulſation did not ceaſe for the ſpace of an hour; the heart of a flounder, cut tranſverſly into two parts, *(e)* retained its motion for a great length of time, though the blood had been ſqueezed out of it by preſſure, and both ſides of it wiped with a cloth.

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*(d)* Boyle's new Exper. concerning Reſpiration, p. 18. *(e)* Boyle of the uſefulneſs of Experimental Philoſophy, Exerc. 1. p. 112.

From ſuch experiments as theſe it was, that *(f)* Galen concluded, the heart did not want nerves for the diſcharge of its proper function, *&c.* that it was a miſtake, to think that the heart was a muſcle, *&c.* and that it was in a manner the fountain of native heat.

Many other experiments of the ſame nature might be brought concerning the hearts of animals; but that the obſervation holds good in the heart of a man appears from the words of Lord Verulam *(g)*, who ſays that *upon the embowelling of a criminal, (which is a kind of puniſhment uſed in England for high treaſon) ha had ſeen the heart of a man, after it was thrown into the fire, leap up for ſeveral times together, at firſt to the height of a foot and a half, and then gradually lower, to the beſt of his memory, for the ſpace of ſeven or eight minutes.*

The natural functions are all thoſe, which are inſtrumental in repairing the ſeveral loſſes, which the body ſuſtains, and making good the ſeveral deficiencies both in quantity and quality. For life is deſtructive of itſelf, the very functions of life occaſion a perpetual waſte, and were we not to receive freſh ſupplies from the food we take down, we ſhould ſoon ceaſe to be. And Galen has juſtly *(h)* obſerved; *quod à ſingulis partibus defluit, tale eſt, qualis ipſa pars. Nihil autem eorum quæ edimus aut bibimus, tale prorſus eſt; hinc neceſſe habuit natura prius immutare* (ϖϱομεταβάλλειν) *& concoquere illas & alendo corpori ſimilia prorſus præparare* (ϖϱοπαϱασκευάζειν); “ that what is carried
“ off from each particular part is of a reſembling na-
“ ture with the part itſelf; and yet what we eat or
“ drink bears no ſuch ſimilitude; for which it was
“ neceſſary, that nature ſhould firſt concoct our food,
“ and change it by a proper preparation into a like
“ ſubſtance with the parts that are to be nouriſhed.”

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*(f)* De anatom. adminiſtrat. Lib. VII. cap. 8. Charter. Tom. VI. p. 155. *(g)* Hiſt. of life and death, p. 559. *(h)* Comment. II. in lib. de alimento Hippocratis, Charter. Tom. VI. p. 245.

The food therefore we take down is not alone ſufficient for this purpoſe, there is farther required a moſt perfect machine of a created body, to turn it into nouriſhment.

Hippocrates, who uſually expreſſes a great deal in a few words, ſays, *(i) alit concoctum*; "food con-"cocted nouriſhes."

And for this reaſon he *(k)* obſerved in his Aphoriſms, *à morbo bene comedenti nihil proficere corpus malum*, "that a diſeaſed perſon receives no benefit from "taking down a large quantity of food, whilſt he is "ſick:" meaning, that the concocting powers were wanting, or, which is the ſame thing, that nature was itſelf deficient.

Now what are we to underſtand by nature, (φύσις,) the old word uſed by Hippocrates, which has by many been ſo ill explained? Why nothing elſe, but the aggregate of all the phyſical conditions, which are required to that moſt conſtant, durable, and at the ſame time active power of moving, wherein life conſiſts; now this is perfect health; if there be any thing wanting thereto, nature is deficient, and the defect is a diſeaſe.

Phyſicians therefore do no injury to the Supreme Being, when they aſcribe ſo much to nature; as they hereby underſtand the conſtitutional frame of the created body.

It was therefore well ſaid by Helmont *(l)*, *Naturam eſſe juſſum Dei, qua res eſt id quod eſt, & agit quod agere juſſa eſt*; "that nature was the order of God, "by which a thing is what it is, and acts what God "has ordered it to act."

Upon the ſame ſubject Hippocrates, *(m) Natura omnia omnibus ſufficit*; "nature ſupplies all things to "all;" *(n)* (νόσων φύσιες ἰητροί) *morborum naturæ medicæ*;

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*(i)* De alimento. Charter. Tom. VI. p. 245. *(k)* 31. Sect. II. Charter. Tom. IX. p. 37. *(l)* Pag. 38. *(m)* Sexto Epidem. Charter. Tom. IX. p. 509, & 513. *(n)* De alimento, Charter. Tom. IX. p. 264.

*cæ; & invenit natura ſibi ipſi vias, non ex intellectu* (οὐκ ἐκ διανοίης); *à nullo edocta natura, & citra diſciplinam omnia, quæ conveniunt, efficit*; "diſeaſes are "cured by nature; and nature has found out ways "of itſelf without art or contrivance; nature untaught "does all things neceſſary of itſelf without inſtruction;" to which paſſage of Hippocrates *(o)* Galen ſeems to have alluded, when he writes, (φύσεις γὰρ ζώων ἀδίδακτοι) *naturæ enim animalium à nullo doctæ ſunt, dicit Hippocrates*; "that according to Hippocrates, the na- "tures of animals are untaught." And this he confirms by divers examples, for inſtance, the calf buts with its forehead before its horns are grown, and the colt kicks whilſt its hoof is yet tender, *&c.*

The manducation therefore of our food, the deglutition of it, and digeſtion in the ſtomach and inteſtines, the ſeparation and diſtribution of the chyle, the ſecretion of the excrements, *&c.* are brought under the head of natural functions, as by theſe our meat and drink are converted into our nature.

The name of Animal is given to all the changes wrought in the body of a living man, which occaſion a change in the thoughts of the mind, or are produced by a thinking mind.

Theſe functions therefore all of them ſuppoſe thought.

That which thinks is called the mind; for the firſt thing that we know of the mind is that it thinks. Is this thinking then the mind itſelf? It is, ſure; that though all things were to remain in the ſtate they are, they would be nothing with reſpect to us, if we did not think, and this is all we know of the mind.

Some of theſe functions are diſcharged, when new thoughts ariſe in the mind, either from an external or internal cauſe, by a preceding change in the bodily organs though almoſt entirely ſuperficial; thus the mind diſcerns real objects, if the eye be good; but ſick

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*(o)* De uſu partium, Lib. I. cap. 3. Charter. Tom. IV. p. 286.

ſick people often imagine they have objects before them which are not preſent, from a change in the bodily organ merely by internal cauſes, and not occaſioned by external objects.

Other animal functions are diſcharged, when the mind, from a change in its own thoughts, works a change in the body, by raiſing ſome muſcular motion: *v. g.* a man wills to lift up his arm, and it is ſtraightway lift up; for it is a property inherent in man, that as his will directs, he ſhall be able to excite motion, continue, direct, change, ſtop, or renew it.

It is ſtrange indeed, that as theſe motions thus excited by the will are in themſelves ſo evident, and mechanically produce ſuch notable changes in other bodies, they ſhould yet ſcarce ſeem to be originally corporeal, or have any apparent cauſe; I mean, that there ſhould be ſeen no phyſical change in the body, excluſive of the action wrought, nor any footſteps of the alteration, when the will has put a ſtop to the motion.

Theſe actions are farther all of them wrought without any knowledge of the cauſe; for the moſt ſkilful anatomiſt can perfom them no better than an idiot; which is ſure a matter of the deepeſt ſpeculation.

All other animal actions are uſually ſuppoſed to belong to what are named the internal ſenſes; *i, e.* the memory, the imagination, the affections of the mind, attention, *&c.*

For the mind is capable of thinking without any aid from the external ſenſes by virtue of its own powers, and meditating as it were apart by itſelf.

Thus we often remember, that we had once an idea, which we cannot now recollect. The thinking principle then ſearches for this idea in its own ſtorehouſe within; and though it knows not exactly what it ſeeks for, it yet diſtinguiſhes it from all other things which then offer themſelves to its thoughts.

Yet even theſe inmoſt thoughts are capable of being changed, and even quite effaced by a change in the body. For how often have we ſeen in caſes of melancholy the imagination of the wiſeſt men depraved, and the memory deſtroyed, *&c.*

And though Hippocrates ſaid *(p)*, *qui aliqua parte corporis dolentes ut plurimum dolorem non ſentiunt, illis mens laborat* (γνώμη νοσέει); "that diſeaſed perſons, who "were not ſenſible of their indiſpoſition, laboured "under a diſtempered mind;" yet in this caſe he applies remedies, not to the mind, but to the body. For when he was ſetting out for Abdera, at the requeſt of the inhabitants, to cure Democritus, whom they apprehended to be mad, he gave directions to Cratevas to collect the herbs he judged proper for the cure *(q)*.

It is upon the body that medicine almoſt conſtantly acts, even in thoſe diſeaſes where there is no apparent change in the body, but merely a change of the thought. Thus in one ſpecies of madneſs, for inſtance, the moſt ſagacious Phyſicians can diſcover nothing amiſs in the corporeal ſyſtem, and yet the man raves outrageouſly without a fever. In theſe caſes, however, they have conſtantly applied ſuch remedies, as by their prodigious force might be able ſo to rouze the whole ſyſtem of nerves, veſſels, and muſcles, as to leave no part remaining in the ſame ſtate wherein it was before; with this view, that by thus ſhaking the whole frame, the latent impreſſion on the ſenſorium commune, from whence the diſeaſe aroſe, might be eraſed.

Thus Melampus of old, who lived long before the Trojan war, upon obſerving the madneſs of goats to be carried off by hellebore, by the ſame means ſucceſsfully cured the king's daughters of this diſeaſe; from whence Hippocrates alſo has named hellebore Melampodium.

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*(p)* Aphor. 6. Sect. 2. Charter. Tom. IX. p. 47.

*(q)* If Hippocrates be the author of thoſe epiſtles, which are commonly aſcribed to him.

SECT.

## SECT. II.

THAT part of the ſcience of phyſic, which teaches how to find out and cure the diſeaſe that afflicts the patient, is called the practice of phyſic.

The chief end of all knowledge in the art of phyſic is to reſtore health to the ſick. And hence Celſus has juſtly obſerved, (a) *ut alimenta ſanis corporibus agricultura, ſic ſanitatem ægris medicina promittit*; “ that “ as healthful perſons have reaſon to expect a ſupply “ of food from agriculture, ſo have the diſeaſed cauſe “ to hope for the recovery of their health from the “ uſe of medicine.” Practice therefore, ſo called ἀπὸ τȣ͂ πράττειν, is that part of the ſcience of phyſic, which teaches how to find out by undoubted natural ſigns in the patient, when there is a diſeaſe, what that diſeaſe is, in what ſtate, whether in its beginning, increaſe, height, or declenſion, and by what method and means this diſeaſe, now found out, may be carried off.

All theſe conſiderations are farther to be applied to the caſe of the ſick perſon that is viſited. For it is quite a different thing to deſcribe a pleuriſy, and to point out by the rules of art, that the ſick perſon you viſit labours under this diſeaſe, eſpecially as in its different ſtages it requires a different treatment, though it is always called by the ſame common name.

Such Phyſicians as now practiſe this art, were formerly called Clinics by the Antients, from viſiting ſick perſons as they lay (ἐν κλίναις) in their beds.

## SECT. III.

WHoever therefore is unacquainted with what is requiſite to the juſt diſcharge of the vital, natural, and animal functions, and of courſe is ignorant of the cauſes of life and health, can never rightly diſcern their defects, *i. e.* diſeaſes.

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(a) Pag. 1. in ipſo initio præfationis.

A Phyſician therefore muſt know what the diſeaſe is, before he can cure it; for a diſeaſe (as we have obſerved) is the diſorder of ſome function requiſite to health. How then ſhall he know what is amiſs in this function, who is not acquainted with all that is required to the due diſcharge of it? It is a juſt obſervation in Galen (*a*), *cujuſque morbi tanta magnitudo eſt, quantum à naturali ſtatu recedit, quantum verò recedat, is ſolus novit, qui naturalem habitum ad amuſſim tenuerit*; "the degree of a diſeaſe muſt be computed by the "degree of its departure from a natural ſtate, and "what this is he can only know, who is thoroughly "acquainted with the natural ſtate."

Blindneſs, for example, is the name of a diſeaſe ſignifying the loſs of ſight. This diſeaſe may take its riſe either from a concretion of the eye-lids, the obſcuration of the cornea, after violent inflammations, or ſcars left in it, *&c.* the aqueous humour grown turbid, or the cryſtalline humour opake, may take away ſight; the optic nerve expanded on the retina may become ſenſeleſs; the ſame nerve too may be compreſſed by various tumours, an exoſtoſis, *&c.* in any part of its courſe from the ventricles of the brain to the eye; or the origin of the misfortune may lie in the ventricles of the brain themſelves.

Now he who is unacquainted with the fabrick of the organ, and conſequently unable to diſtinguiſh among ſo many poſſible cauſes which is the real one, from whence the preſent diſorder proceeds, how ſhall he be able to apply the proper remedies?

In the caſe of blindneſs following upon a burning fever, where the ſtagnating blood was ſcarce able to move

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(*a*) De methodo med. ad Glaucon. Lib. I. cap. 1. Charter. Tom. X. p. 345.

move through the diſtended arteries, in vain were collyria applied to the eyes, which were ſtill clear and bright; a Phyſician of judgment placed all his hope in a large and ſalutary diſcharge of blood from the noſtrils; by which means the veſſels being emptied, and the inflammatory ſize attenuated, the ſight was perfectly reſtored.

To this may be objected the ſkill of Hippocrates in this art, which has gained the approbation of ſo many ages, who, without all thoſe beautiful diſcoveries which the preſent age enjoys, made ſuch great advantages in the art of healing, ſolely by his obſervation of the appearances in diſeaſes themſelves.

But certainly Hippocrates, great as he was, would have ſtill been greater, had he been acquainted with the diſcoveries of the Moderns.

Whence then is it, that after ſo many new diſcoveries, the art of phyſic ſtill falls ſhort ſo much of certainty? The reaſon ſeems to be this:

The induſtry of the Moderns has indeed made many diſcoveries concerning the ſtructure of the body, though more ſtill lie concealed, and perhaps will do ſo long. Phyſicians growing vain upon theſe improvements, and being too much inclined to form hypotheſes, from a few obſervations, have laid down general rules for practice. And if any thing occurred in diſeaſes which did not well agree with their preconceived hypotheſis, they either entirely neglected it, or tortured it by force into a ſeeming agreement.

Thus would they make the art ſhort, which the wiſdom of antiquity pronounced long.

This itch of forming general rules, and reducing the art to a few axioms, has long prevailed. The Methodiſts of old thought it ſufficient (b) *quædam communia morborum intueri*, "to conſider ſome of the "common properties of diſeaſes;" and theſe they divided into three kinds, whereof one was ſuppoſed to ariſe from too great a retention, another from too large a diſcharge, and a third from an intermixture of both theſe.

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(b) Celſus in præfatione, L. I. p. 15.

They therefore who to the correct obſervations of the Antients join the diſcoveries of the Moderns, ſeem to lay the beſt foundations for raiſing a juſt ſuperſtructure.

## SECT. IV.

A Cure therefore is the changing of a diſeaſe (1) into health (2). This therefore ſuppoſes alſo the knowledge of what we have already mentioned (3); and conſequently the knowledge and cure of diſeaſes require the knowledge of thoſe principles, which explain what life and health is; *i, e.* an acquaintance with the theory of phyſic.

The firſt part of the practice of phyſic takes in the diſcovery of diſeaſes; the other teaches how a diſeaſe when found out may be cured.

But to this cure is required the like knowledge of all that we have mentioned above; for a cure is ſuch a change of the body, as removes the ſtate which was termed a diſeaſe, and reſtores the ſtate, whereof the privation occaſioned the diſeaſe. An example will make the matter plain.

That kind of paronychia, in which with ſcarce any ſwelling a moſt acute pain ſeizes the laſt joint of the fingers, attended even in otherwiſe the moſt healthful perſons with a violent fever, ſyncope, phrenzy, convulſion, and oftentimes death before the third day, owes all its malignity to the peculiar ſtructure of the part: for the tendons which bend the two laſt joints of the fingers are covered by a ſtrong ligament, almoſt as hard as a cartilage, deſcribed formerly by Galen (*a*). Now

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(*a*) Galen. admin. anatom. Lib. I. cap. 5. Charter. Tom. IV. p. 56.

Now if an inflammation be formed under this ſtiff ſhield, (whether it be from the ligament itſelf, the membrana cellulоſa; the perioſteum, or tendons, it matters not) all theſe terrible ſymptoms follow, becauſe the part inflamed lies under this hard covering, which cannot give way. A Phyſician called in time, who is acquainted with the ſtructure of the part, boldly orders all the integuments to be cut through with a lancet on the ſide of the finger down to the bone. By this means changing the ſingular ſtructure of the part into a like ſtate with that of the reſt of the body, the pain is ſtraightway aſſwaged, and this threatening diſorder eaſily yields to the application of emollient medicines.

The truth of this propoſition might be demonſtrated by more examples, but this one is ſufficient.

## SECT. V.

THAT change either (4) occaſions, ſtops, or directs a certain motion, by the application of ſuch inſtruments, as the artiſt ought to know and direct; and thus we ſuppoſe him acquainted with all that relates to diet, medicines, and ſurgery, the manner how they are to be prepared, and the method of applying them.

There can be no cure, unleſs there be ſtill left ſome degree of life and of motion in the vital humours through the veſſels. It is this motion which gives activity to the remedies applied, for on a dead body they would produce no effect. We increaſe this motion when too languid, as in many chronical diſeaſes; or with prudence allay it, when it would deſtroy the body by its violence, as in very acute ones; or when it ruſhes on ſome particular part with too much force, we divert it to another by revulſion.

When the body languiſhes under a load of pituitous matter, we rouze by acrid ſtimulatives. If a man be raving in an acute phrenzy, we weaken by bleeding, and avert the violence from the head, all we can, by bathings, fomentations, ſcarifications, and the like.

But theſe are all performed by certain inſtruments, which, applied to the diſeaſed body, ſo change it as to produce health; theſe inſtruments are called medicines.

Concerning theſe Hippocrates ſays *(a)*, *omnia medicamenta ſunt, quæ præſentem ſtatum* (τὸ παρεὸν) *dimovent, vehementiora autem omnia immutant*, &c. *ægrotanti verò omnia è præſenti ſtatu dimovere conducit*; "that all medicines alter the preſent ſtate of the patient, but ſuch as are moſt efficacious make a thorough change in the whole frame, *&c.* which in a diſeaſed perſon is a neceſſary circumſtance towards a cure."

Theſe inſtruments are applied to the human body by diet, medicine and chirurgery.

In the firſt ages of phyſic the care of all theſe belonged to the ſame Phyſician.

But about the time of Herophilus and Eraſiſtratus, phyſic was divided into three branches; whereof one cured by diet, another by medicines, and the third by manual operation *(b)*.

It would be a reproach to an artiſt not to know the inſtruments of his own profeſſion; and ſuppoſing a Phyſician to have clearly diſcovered what ought to be changed in the body to produce health; yet if he knows not by what means to effect the change, he will do no ſervice.

Nor is it enough to have curſorily learned the names of his medicines, for without a perfect knowledge of their nature and properties, he would ſoon expoſe himſelf by the improper form of his preſcriptions, and frequently do his patient a prejudice.

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*(a)* De locis in homine, cap. 16. Charter. Tom. p. 375.

*(b)* Celſ. præfat. p. 3.

For how is the nature of medicines changed by their various preparations! the Syrian ſcammony given pure, diſſolves the humours into a putrid water, and then carries them off by ſtool; yet the ſame medicine, by being expoſed to the vapour of burning ſulphur, as in making the *diagridium ſulphuratum*, is rendered almoſt inactive.

The root of rhubarb infuſed in hot water forms an innocent purge for every age and ſex; but by long boiling loſes both its fragancy and virtue.

A Phyſician ought alſo to be acquainted with the different methods of uſing drugs. Reſin of jalap given alone, and by its tenacity adhering to the folds of the ſtomach and inteſtines, has frequently brought on an *hypercatharſis*; but if this quality be corrected by pounding it with a little ſugar, or the yolk of an egg, it may then be uſed with far more ſafety.

Hippocrates uſed to drop the very acrid juice of tithymal into figs, that it might not injure the throat in its paſſage *(c)*.

Innumerable other examples of the ſame nature might be brought to ſhow, how neceſſary the knowledge of the *Materia Medica* is to a Phyſician.

## SECT. VI.

THE application of theſe means is directed by a foreknowledge of their effects, which requires a general knowledge of the laws, according to which thoſe actions are performed; which ſhews the doctrine of the ſigns, and of the method of healing, to be a neceſſary ſcience. So that whoever deſigns to lay down rules for the practice of phyſic, ought firſt to be well acquainted with every branch of the theory of phyſic. This therefore we ſhall now ſuppoſe, not only known, but alſo demonſtrated in another place.

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(c) De victu acut. Charter. Tom. XI. pag. 183.

But the difficulty here lies in being able ſo to direct theſe inſtruments, as to effect the change which art requires to the reſtoration of health.

For the application of all medicines is made to a living body; they are brought into action by life, and frequently produce different, and ſometimes oppoſite effects, in different ſubjects, from a particularity of conſtitution; nor can this be ever determined beforehand, but is only to be learnt from experience.

The ſame medicine ſhall produce a different effect in ſickneſs and in health. The bile exalted by violent ſummer-heats, if irritated by ſome gentle purge, ſhall frequently bring on an enormous quantity of ſtools; while ſix times the doſe given to a man in a dropſy ſhall not occaſion a ſingle motion. Five grains of *mercurius vitæ*, given to a woman in a maniacal caſe wrought no effect; though before ſhe was afflicted with this diſeaſe, a few grains of ſcammony threw her into fainting fits, through the violence of its operation.

In chronical diſeaſes, where the viſcera are almoſt tabid and ready to fall to pieces, how dangerous is it to give even the mildeſt vomit of Ipecacuanha.

Theſe are points, which require the attention of a prudent Phyſician; for when a medicine is once adminiſtered, the effect is no longer in his power.

It was Galen's obſervation (*a*), *ſive purgans dederis, ſive vomitorium*, &c. *primo exhibitio in tua poteſtate eſt, reliqua ſibi fortuna vindicat*; "whether you give a "purge or a vomit, *&c.* the adminiſtration is in your "own power, but the conſequence muſt be left to "fortune."

Beſides, in diſeaſes nature ſo often endeavours by unknown ways to expel the latent morbid matter,

whether

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(*a*) Galen de venæ ſectione, adverſus Eraſiſtratum cap. 7. Tom. X. p. 401.

whether it be the cauſe of the diſeaſe or its effect, that he who ſhall imprudently diſturb her in theſe good beginnings by oppoſite remedies, muſt always do miſchief.

And hence the doctrine of ſigns, and the method of healing, are ſciences abſolutely neceſſary; and for the ſame reaſon it is, that Hippocrates is ſo very minute in the enumeration of ſigns.

So that upon the whole we may conclude that every branch of the theory of phyſic is neceſſary to be known by him, who would attempt to learn the practice.

Galen made the ſame concluſion when he ſays, (*b*) *at non propter ſe cætera omnia ad artem ſpectantia aut diſcimus, aut docemus, aut denique auſcultamus, ſed quod eorum unumquodque ſit ad finem utile*; "all other particulars relating to the art we neither learn, nor teach, nor even give ear to upon their own account, but merely as each of them is ſubſervient to the end we aim at."

## SECT. VII.

A Diſeaſe, as it is ſeated in the body, muſt be the bodily effect of ſome particular cauſe, directed to that body.

From what we have before obſerved on Sect. I. it is plain that Phyſicians in all ages have applied medicines to the *body*, even in thoſe diſeaſes where the functions of the *mind* only ſeemed to be diſordered. Nobody every doubted whether the diſeaſe and its cauſe were both inherent in the body, when they perceived a ſenſible change in the body, but many have fancied it a paradox to form the ſame judgment of thoſe diſeaſes, wherein the *thought* only appears to have been affected.

But

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(*b*) Comment. in Hippoc. de officina medici. Charter. Tom. XII. p. 3.

But the thinking principle within us ſeems to be immutable, ſimple, always and every where the ſame: for let me think of what I will, I know it is I who think; I know of what I think; and though I think of different things every moment, there muſt remain in me who think, ſomething which is always the ſame amidſt the infinite variety of objects that affect my thoughts.

This thinking principle, according to the direction of the adorable Creator, is ſo united to the body, as that a change in the body ſhould make a change in the thoughts: and, on the other hand, a change in the thought can make a change in the body. All therefore that lies in the power of medicine is, by changing the body to amend the injured action of the mind that is united to it: for it is often a very ſlight diſorder in the body which overſets the whole mind. Thus ideots are almoſt always obſerved to have the ſhape of their heads depraved from the birth. So a ſingle ounce of blood extravaſated under the ſkull effaces all our humanity. A boy *(b)* of eight years old during a hot ſeaſon uſed to loſe the memory of all that he had learned, but two or three days cooler weather would reſtore it again, and with the hot weather the ſame calamity returned.

Innumerable other inſtances confirm this matter.

A Phyſician therefore conſiders diſeaſes as conſiſting in a change in the body.

## SECT. VIII.

THE entire removal of which is the cure.

When a Phyſician therefore by a careful examination has found what it is in the functions that deviates from health, and by what cauſe that change in the body is wrought which is named a diſeaſe, he then labours by all the known aſſiſtances of art, to take this

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*(b)* Hiſtoire de l'Academie de ſciences, 1705. p. 73.

cauſe away. For the axiom is allowed to hold univerſally, *take away the cauſe, and the effect will ceaſe.*

It is to be carefully obſerved here, that it is very poſſible the cauſe of a diſeaſe may be removed, and of courſe the diſeaſe itſelf, and yet ſeveral of the functions may be left depraved by the preceding diſeaſe. A man labours, for example, ſo long under a ſevere autumnal quartan ague, till by the repetition of the fits the ſolids are ſo weakened, and the fluids ſo diſſolved, that a dropſy enſues. Give him the Peruvian bark, the fever is cured, but the dropſy remains. This however will warrant no ſuch concluſion, as that by taking away the cauſe of the diſeaſe you have not taken away the effect; for the Peruvian bark has ſo ſubdued the cauſe of the fever, that its effect, the fever, is gone; but the fever has ſo changed the body as to make it dropſical: and though the fever be removed by the bark, yet thoſe cauſes remain from whence the dropſy followed as an effect, namely, the too great weakneſs of the ſolids and diſſolution of the fluids.

## SECT. IX.

THIS removal is obtained, by correcting that particular illneſs, either by the application of a remedy to the part particularly diſeaſed, or by remedies operating actually upon the whole. The latter we ſhall call a general, the former a particular one.

We have a twofold method of removing diſeaſes, either by acting directly on the diſeaſes themſelves, without changing the reſt of the body, or by changing the whole body to deſtroy and expel the diſeaſe.

A quartan, which had been treated in vain with purges, vomits, ſweats, and which even kept its courſe in the midſt of a ſalivation (as I myſelf have ſeen), was cured by the Cortex Peruvianus, without producing any other viſible change in the body. This therefore

fore we call a peculiar or ſpecific remedy, as in carrying off the fever it works no other change in the body. Opium ſwallowed down and lying in the ſtomach removes all ſenſe of pain, without diſturbing the body. And poſſibly there may be in nature reſembling remedies for other diſeaſes, which Phyſicians would be happy if they could but find out.

A ſtone falls from the kidney into the pelvis, and thence into the ureter; and thence ariſes intolerable pain with convulſions of the lower belly, nauſea, vomitings, *&c.* if the Phyſician now knew a remedy by which to diſſolve the ſtone that is lodged there, this would be a preſent cure; but for want of this he is forced to change the whole body by fomentations, clyſters, bleeding, and the moſt emollient decoctions, that he may expel the enemy through the now relaxed and lubricated paſſages; and this is called a general cure.

This method generally acts by introducing another diſeaſe. For when the Phyſician cures the lues venerea by ſalivation, the patient is laid up for a month at leaſt before he can be freed from this terrible diſeaſe.

Herein we imitate the ſalutary proceeding of nature, which often expels the cauſe of a diſeaſe by a commotion of the whole body.

If a little bread falls through the mouth of the larynx, nature by her faithful guards, the nerves, excites a moſt violent fit of coughing, nor ſuffers it to reſt till the bread is thrown out.

And hence Sydenham boldly concludes, that *a diſeaſe, how adverſe ſoever its cauſe may be to the human body, is nothing elſe but nature's endeavour with all her might to expel the morbific matter, for the good of the patient* (*a*).

## SECT. X.

BOTH are diſcovered, either by obſervation, by comparing one caſe with another, or by reaſoning from theſe together.

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(*a*) Pag. 39.

There is no doubt, but both medicines, and the practice of phyſic, were diſcovered by ſingle obſervations; for the firſt advances in phyſic ſeem to have taken riſe from mens adviſing others in ſickneſs, to make uſe of remedies which they had found beneficial to themſelves or others, in hope they might prove ſucceſsful to them in like manner.

And when they ſaw others labouring under a diſeaſe not entirely the ſame, but yet bearing ſome reſemblance to one they had obſerved before, they concluded from this likeneſs that they required a reſembling method of cure.

The ſect of the Empirics contended that the whole medicinal art reſted on theſe two methods only: for they ſaid, (*a*) *diligentes homines hæc notâſſe, quæ plerumque meliùs reſponderent, dein ægrotantibus ea præcipere cœpiſſe*; *ſic medicinam ortam, ſubinde aliorum ſalute, aliorum interitu, perniciosa diſcernentem à ſalutaribus*; "that perſons of diligence had marked down the remedies, which in general had beſt anſwered, and "thence took occaſion to preſcribe them to the ſick; "and that thus, from the recovery of ſome, and the "death of others, the practice of phyſic had its riſe, "as it diſtinguiſhed the applications which were hurtful from ſuch as were attended with benefit."

If an unknown diſeaſe occurred, (*b*) *medicum protinus viſurum, cui morbo id proximum ſit, tentâturumque remedia ſimilia illis, quæ vicino malo ſæpe ſuccurrerint, & per ejus ſimilitudinem opem reperturum,* &c. *latentium vero rerum conjecturas ad rem non pertinere, quia non interſit, quid morbum faciat, ſed quid tollat*; "the Phyſician was then to conſider, what diſeaſe it reſembled, and by applying ſuch remedies as he had often "experienced to ſucceed in a like caſe, he might be "able from the reſemblance to adminiſter relief in "this, *&c.* but that conjectures concerning the latent "cauſes of diſeaſes were of no conſequence, as it matters

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(*a*) Celſus præfat. Lib. 1. pag. 9. (*b*) Celſus ibid. pag. 10.

“ ters not what it is that cauſes a diſeaſe, but what
“ can remove it.”

By reaſoning correctly from theſe two, many uſeful deductions may certainly be made, provided that nothing be admitted as an obſervation that is uncertain, nor any concluſion drawn from thence that is contrary to experience. For it is certainly juſt advice, with which Celſus concludes his examination of the diſputes which paſſed between the Empyrical and Rational ſect of Phyſicians (*c*), *rationalem quidem medicinam eſſe debere: inſtrui vero ab evidentibus cauſis; obſcuris omnibus, non à cogitatione artificis, ſed ab arte ipſa rejectis*;
“ that the practice of phyſic ought indeed to be
“ grounded on reaſon, but that evident cauſes only
“ ought to be admitted, all ſuch as were obſcure be-
“ ing not only to be rejected from the conſideration
“ of a Phyſician, but from the art itſelf.”

## SECT. XI.

OBſervation is taken; 1. From an accurate hiſtory of the diſeaſe, giving an account of its cauſes, nature, and effects; 2. From an exact enumeration of all ſuch things, as have proved beneficial or hurtful, whether given to the patient by accident or deſign; 3. From the inſpection of opened bodies, whoſe diſeaſes had been well obſerved before their death.

1. When a man is firſt taken ill, there is a change wrought in him from a ſtate of health, otherwiſe there would be no diſeaſe. This departure from health we may diſcover by our ſenſes. As the diſeaſe proceeds, he declines ſtill more from a healthful ſtate, new changes daily appear, and thoſe which were taken notice of before do either increaſe, remain the ſame, or diminiſh, and even ſometimes quite diſappear; theſe particulars

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(*c*) Ibid. p. 20.

ticulars carefully obſerved in the order they follow one another give the hiſtory of the diſeaſe. But now a diſeaſe, as an adequate effect, is the ſame with its compleat or proximate cauſe, the preſence of which ſuppoſes its diſeaſe, and the abſence its removal. This proximate cauſe is ſeldom ſimple, but generally compounded of other cauſes, which ſingly would not be ſufficient to produce the diſeaſe, as they do when united. *v. g.* The proximate cauſe of a pleuriſy is an inflamed ſizy blood, driven into veſſels too ſtrait for it to paſs through, and having its motion farther increaſed by a fever. No one of theſe three cauſes alone makes a pleuriſy, but all uniting conſtitute the diſeaſe. Theſe cauſes now which jointly make up the proximate cauſe, are either the pre-diſpoſing cauſes (προηγȣμέναι) or (προκατάρκτικαι) the occaſional.

For inſtance, a plethoric perſon, after violent muſcular motion in a very hot ſeaſon, by the rupture of an artery in the cerebrum, falls into an apoplexy. The remote pre-diſpoſing cauſe in this caſe was the plethora, the occaſional cauſes the heat of the air and the increaſed impetus of the blood by muſcular motion; but neither the heat of the air, nor the muſcular motion, would have brought on the apoplexy, if the man had not been plethoric.

This was well obſerved by Galen, where he ſays *(a)*, *corpore noſtro ad morbos quaſi præparato, externum quoddam adveniens febrim accendit, quod ex ſe morbum vehementem minime generaret, &c. et propter corporis diſpoſitionem unumquodque horum non morbi cauſa ſed occaſio redditur; has cauſas vocaverunt* προφάσεις; “ that the “ body being in a manner prepared for the reception “ of a diſeaſe, the intervention of an external cauſe “ ſhall raiſe a fever, which of itſelf would have been “ inſufficient to have produced any diſtemper of con“ ſequence, *&c.* but through the diſpoſition of the “ body becomes rather the occaſion, than properly “ ſpeak-

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*(a)* Comment. 4. in Hippocrat. de victu acut. Charter. Tom. XI. pag. 178.

“ ſpeaking the cauſe of the diſtemper. This ſort of “ external cauſes have been termed προφάσεις.”

Celſus writes much to the ſame purpoſe (*b*), *nihil omnino ob unam cauſam fit, ſed id pro cauſâ apprehenditur, quod contuliſſe plurimùm videtur*; *poteſt autem id, dum ſolum eſt, non movere, quod junctum aliis maxime movet*; “ no diſeaſe is abſolutely owing to a ſingle “ cauſe, but that is judged to be the cauſe, which “ apparently moſt contributes to produce it; for “ that, which ſingly can produce no viſible effect, “ oft proves extremely efficacious in conjunction “ with other cauſes.”

He now that by accurate obſervation hath thus diſcovered the proximate cauſe of a diſeaſe, underſtands the nature of it.

The diſeaſe, however thus underſtood in its cauſes, in the progreſs of it is changing the ſtate of the body every moment, and doing ſtill farther miſchief to the functions, and thus produces as it were new diſeaſes, which are called effects of the diſeaſe, or ſymptoms: for under this name are comprehended all thoſe preternatural appearances, which are ſeen in the patient from the diſeaſe as a cauſe, yet ſo as that they may be diſtinguiſhed from the diſeaſe and its proximate cauſe.

For inſtance, a man in a pleuriſy, through the ſharpneſs of his pain, dares not dilate his breaſt in order to draw in his breath; by this means the blood paſſing with difficulty from the right ventricle of the heart, through the lungs, begins to be accumulated there, and forms a peripneumony. This now is a new diſeaſe, but ſpringing from the pleuriſy as its cauſe.

2. In all diſeaſes life ſtill ſubſiſts, and life is always in action; the ſick man therefore either is in motion and does ſomething, or is at reſt and does nothing, he either eats and drinks, or he does not; and theſe are followed with certain effects good or evil. Now the Phyſician obſerves all that paſſes during the diſeaſe, what does good and what does harm, and then forbids

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(*b*) In præfat. Lib. I. pag. 16.

the one and preſcribes the other; this is the doctrine of things uſeful and hurtful, which is of ſo great account in practice, and which gave the firſt riſe to the art of phyſic. See Celſus *(c)*.

By accident.] In the various trials made ſometimes by the ſick, unforeſeen and remarkable changes are frequently brought about, which adminiſter occaſion for very beautiful diſcoveries in the art. Thus Galen ſays he has often ſeen *(d)*, *non paucos febre ardente laborantes, cum jam mediocriter concocti humores eſſent, ſtatim ex frigidæ potione liberatos*; "ſeveral perſons "in violent fevers cured by drinking cold water, "when the humours were pretty well concocted."

An epilepſy was cured by ſpontaneous ulcers on the head, whence Tulpius concluded *(e)*, that artificial ones alſo might be of ſervice. I have ſeen a man extremely delirious in an acute continual fever, preſently brought to his ſenſes again, upon hearing that his neighbour's houſe was on fire.

Or deſign.] For though a Phyſician ſhould have done every thing according to the rules of art, yet he ought carefully to attend the event, and obſerve whether it does good or not. Hippocrates lays down ſome certain ſigns, whereby to judge, whether a purging medicine that has been taken ſhall have done ſervice or no *(f)*, *ſi*, ſays he, *qualia purgari decet, purgentur, tum confert, tum facile ferunt, ſi è contra, difficulter*; "if the humours be avoided, which ought to be car-"ried off, the patient will be relieved, and eaſily bear "the diſcharge; but if not, the contrary effect will "follow." For reaſon directs us to abſtain from what we ſee does harm. But to arrive at any certainty in judging of things uſeful and hurtful, it is requiſite that we attend with the utmoſt circumſpection to the nature of the diſeaſe, elſe that will very often be attributed to the medicines given, which was owing to the

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*(c)* In præfat. p. 9. *(d)* Galen. Meth. Med. Lib. IX. cap. 16. Charter. Tom. X. pag. 220, 221. *(e)* Obſer. Med. obſ. 8. *(f)* Aphor. 28. Sect. 1.

the diſeaſe only. Thus in a ſemitertian there is an exacerberation of the fit every other day by the nature of the diſeaſe; in this caſe it would be very wrong to aſcribe the ſymptom of the fits at this particular time to the medicines adminiſtered.

3. I wiſh we had more frequent opportunities of looking into dead bodies: How cautious would Phyſicians then be in the treatment of diſeaſes, when they knew that they were obliged to ſhew in the body of the diſeaſed, whether they had judged rightly before of the nature of the diſeaſe, and how many of the latent cauſes of the diſtempers would then be laid open *(g)*! Herophilus and Eraſiſtratus diſſected criminals alive, and thought it no cruelty to expoſe a few guilty men to torment, in order to find out remedies for the innocent, in all future ages; and yet many at this day exclaim againſt opening the bodies of the deceaſed, as a ſhameful and cruel practice, though it be to render medicine more certainly beneficial to the living. Yet even here the utmoſt caution is neceſſary: for the dead body only ſhews us what its ſtate was at the time of death, and a great many changes will be found made in it by the diſeaſe, which however they may be effects of the diſeaſe, would be very improperly reckoned to be the cauſe of it. So when a pleuriſy ends in a ſuppuration, and a Phyſician inſpecting the dead body finds a large quantity of purulent matter collected in the cavity of the thorax, it would be very wrong to conclude that this purulent matter was the original cauſe of the diſeaſe.

The careful inſpection of bodies after death has certainly afforded a great number of diſcoveries, which Phyſicians otherwiſe would not have ſo much as dreamed of. Who would have believed that the œſophagus could have been burſt by a violent fit of vomiting; that the ſpleen growing to an immenſe ſize could have fallen down into the pelvis by an elongation of its connected veſſels; or that ſtones could have grown in

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*(g)* Celſus præfat. Lib. I. pag. 7.

in the very ſubſtance of the heart that is always in motion.

Bonetus, by collecting in his *Sepulchretum Anatomicum*, and diſpoſing in proper order the appearances found upon diſſections, has given great inſight into the diſcovery of the latent cauſes of diſeaſes.

## SECT. XII.

HE concludes from analogy or ſimilitude who by comparing the preſent caſe, as yet unknown, with what hath been already obſerved and is therefore known, draws concluſions from thence concerning the nature and cure of the preſent diſeaſe, arguing from what is paſt to what is to come.

This matter will be cleared up by an example. A Phyſician hath obſerved one of his patients to have laboured under an acute continued fever, attended with a pricking pain of the ſide, ſo as to interrupt his inſpiration; and the diſeaſe not being relieved either by ſpitting, bleeding, or any other remedy, a difficulty of breathing comes on and gradually increaſes, and after long languiſhing ends in death. After this, inſpecting the dead body he finds a large bag full of purulent matter, which by compreſſing the lungs had produced a ſuffocation. He then finds in another perſon the ſame appearances, which he had obſerved in the former in the beginning of the diſeaſe, and concludes from their likeneſs that the ſame event is to be feared: he gives to this what he had found beneficial to the former, and labours with all the powers of art to prevent the ſame bad conſequence: this is called, concluding from likeneſs or analogy.

Sydenham's method, when he would trace out the hidden nature of any new epidemical diſeaſe, was carefully to obſerve the manner in which it changed to health, death, or another diſeaſe; what efforts nature exerted when able of herſelf to cure; and after that imitating theſe in like caſes he concluded by analogy.

## SECT. XIII.

LAſtly, he that exactly weighs every individual thing which by obſervation is found to happen to the patient (11), and then compares each with all the other, and farther conſiders them in an oppoſite view to ſuch things as happen in a ſtate of health, and laſtly by the uſe of his reaſon riſes to the knowledge of the proximate cauſe of the diſeaſe, and of the remedies proper to remove it, this man truly deſerves to be named a Phyſician.

What will be the idea of the beſt Phyſician in future times we know not; but he is to be reckoned a good Phyſician now, who makes uſe of all the aſſiſtances by which, through the happineſs of the preſent age, the art of Phyſic has been improved.

Geometry ſhews us, that infinite truths may be diſcovered in the moſt ſimple ſubjects by long examination, which were not thought of before. What is more ſimple than the idea of a circle, which every one eaſily conceives? yet by applying a right Line to it, what beautiful theorems have thence been deduced!

In like manner in the conſideration of diſeaſes; the diſcoveries that obſervation has made are the data, from which when examined with attention and judgment, the ingenious Phyſician infers numberleſs and moſt uſeful truths.

But each of theſe is to be diligently conſidered apart by itſelf, and not ſlightly paſſed over: For inſtance, when in the beginning of an exact quartan, there comes on that ſurprizing coldneſs, aſcending from the loweſt degree (to ſenſe like that of cool air) to ſuch an extreme rigor, as to make the limbs all ſtiff and inflexible, and frequently to take away all ſenſe, ſo that the perſon affected ſhould burn his legs to the bone without feeling it; with what variety of knowledge does this furniſh the Phyſician? For it is demonſtrated in phyſics that cold is the abſence of fire, or its not being determined to a particular place; and from the known laws of the human body it is now certainly known, that coldneſs is the effect of a diminiſhed circulation; ſo in the beginning of a quartan, we evidently find that the circulation is diminiſhed; the heart indeed beats more ſwiftly, but not being able to overcome the increaſed reſiſtance, it cannot propel the vital blood to the extremities; theſe extreme parts therefore firſt grow pale, the tip of the noſe becomes very pale, the nails and extremities of the fingers, and ſo the lips. And as the cold contracts all the parts, the veins alſo being conſtringed propel their humours towards the right ventricle of the heart with the greater force; the left ventricle of the heart in the mean time is not able to throw out the whole quantity of blood contained in its cavity into the contracted arteries; by which means the blood is accumulated about the heart and lungs, and occaſions that aſtoniſhing uneaſineſs, panting, and ſtruggling, by all the force of reſpiration to throw off the oppreſſing load. Hence we conclude, that there is at this time great danger of death, and reaſon to fear leſt the blood, which almoſt ſtagnates in the larger veins, ſhould run into polypous concretions, which are often not to be diſſolved again during the remains of life.

He therefore is not to be eſteemed a good Phyſician, who only takes notice of the phænomena of diſeaſes, but he that weighs them, and is able to point out what are the neceſſary conſequences following from them.

Nor yet is this ſufficient, but it is farther requiſite that he compare them with each other; for the extreme cold of a quartan, will be followed by a heat gradually increaſing till it comes to be extreme; but heat diſtends, lengthens all the ſolids, and increaſes the bulk of the fluids; the ſolid fibres therefore which were ſhortened by the preceding cold, will be lengthened by the ſubſequent heat; but nothing weakens the frame of the ſolids more, than this alternate change of contraction and relaxation: Hence it is we ſo often ſee a great debility following after a ſtubborn quartan ague, and the many other evils ſubſequent from it.

This is the ſecond uſe we are to make of the phænomena which appear in diſeaſes; the firſt was to conſider each of them apart, intenſely, and in a ſeparate view, and then collect them together in writing for the help of the memory; the ſecond uſe was to conſider them conjointly and thoroughly; and by ſo doing we ſhall attain to the utmoſt degree of certainty that the art is capable of.

He farther conſiders them in an oppoſite view to ſuch things as happen in a ſtate of health.] This is a rule of the greateſt importance in the art. The wiſe Hippocrates, in his *Prognoſtics*, has deduced preſages which have been approved of in all the ages which have paſſed ſince; he there directs us to conſider well the face of the ſick, whether it be like that of a perſon in health, but eſpecially if it be like what it formerly was; and ſays the worſt ſtate of it is, when it is diametrically oppoſite to a healthful countenance, when the noſe is ſharp, the eyes hollow, *&c.* deſcribing that kind of countenance which has ſince been called by Phyſicians the *facies Hippocratica.* He compares the manner how his patients lie in bed with their uſual cuſtom of lying when in health, and ſo far condemns the latter as it departs from the former; ſo he condemns a quick anſwer from a man that had been of a cool temper before; ſo any unuſual action, or great expreſſion of concern for a matter which before was not much regarded, is ſet down in his *Coacæ Prænotiones* as an ill ſign and nearly approaching to a delirium. Innumerable other inſtances of a like nature are to be found in Hippocrates, but theſe may ſuffice.

For there is no ſymptom appearing in diſeaſes, but it is the effect of ſome function diſordered, which was exerciſed in health, and the greatneſs of the diſeaſe is proportioned to the degree of its departure from what it was in a ſtate of health.

And laſtly by the uſe of his reaſon, *&c.*] For he that examines the coldneſs of a quartan ague according to the rules laid down, will conclude its proximate cauſe to be the circulation diminiſhed, through the expelling power of the heart's being leſſened, or the reſiſtance at the extremities of the arteries increaſed, or both together. But why is it here expreſsly ſaid, that we ſhall thus attain to the knowledge of the proximate cauſe? Becauſe the poſſible remote cauſes may be very many nor all eaſy to be known; but by knowing the proximate cauſe, the proper means are diſcovered for taking it away: for when I know what it is that cauſes the cold in a quartan, I eaſily conclude what is to be done to cure or at leaſt to mitigate it: a thin, warm, light aromatic drink, gentle friction, diluting the liquids, relaxing the veſſels, and gently exciting the vital powers, compleat the whole. Phyſicians of old adviſed in this caſe the uſe of bathing, to prevent the acceſs of this coldneſs in a fever.

When Phyſicians have taken a different courſe, how widely have they erred from the truth! Thus upon obſerving that certain bodies when mixed together ſhall occaſion an effervеſcence, and at the ſame time produce cold; they ſcrupled not to ſay, that a like cauſe produced the cold in a fever: whereas death produces a greater cold than is to be found in any quartan.

## SECT. XIV.

THE beſt method therefore for deſcribing the hiſtory and cure of diſeaſes will be, *&c.*

The true method is here delivered in which diſeaſes ought to be deſcribed and cured; I wiſh it were always obſerved: for when a caſe is to be communicated to others for a conſultation, many Phyſicians deſcribe not the appearances of the diſeaſe itſelf, but content themſelves with delivering what they think of the diſeaſe, leaving it to conſultation only to determine what in this caſe ſhould be done. But ſure it is highly neceſſary, to deſcribe all the phænomena obſerved through the whole courſe of the diſeaſe, that the other Phyſicians who are conſulted may likewiſe judge of the nature of the diſeaſe, and thence deduce the juſt indication of what is to be done. But the beſt method of doing this ſeems to be by obſerving the following rules.

1. To ſet down the individual ſymptoms of each particular diſeaſe, ſuch as are peculiar to it, and ſuch as are common to other diſeaſes, in a diſtinct manner, in a proper order, and with the ſtricteſt truth.

1. All thoſe appearances in a diſeaſe, wherein it is known to be different from a ſtate of health, are called ſymptoms; now theſe are individual and proper, and conſtantly occur in every deſcription of the ſame diſeaſe, and can never be ſeparated from it; as for inſtance, in a pleuriſy the ſharp pricking pain, which is felt more violently upon drawing in the breath, attended with an acute continual fever; theſe are termed pathognomonic ſigns.

Beſides theſe, there are ſuch as are common to this diſeaſe with many others; as for inſtance, in a pleuriſy the pains of the head, loins, *&c.* which do alſo occur in a thouſand other diſeaſes, are therefore called common. Now all theſe are to be ſet down in their proper order, as they mutually ſucceed each other, otherwiſe the end of the deſcription is loſt; thus to ſay, that in the ſmall-pox the patient was delirious, would be to ſay nothing from whence any certain prognoſtic could be formed; for it makes a great difference, whether the delirium comes on before or after the eruption; and if Phyſicians in former times had not obſerved this, how could they have foretold what would happen on the ſeventh day, from what appeared on the fourth?

It is a ſaying of Hippocrates (*a*), *præterita diſcere, præſentia noſcere, futura prædicere, oportet*; "paſt "things muſt be learnt, preſent known, and things "future be foretold."

With the ſtricteſt truth.] All theſe particulars are to be ſet forth as they have occurred in the courſe of the diſeaſe, and muſt not be wreſted to any pre-conceived hypotheſis.

2. To rehearſe all that happened to the patient from thoſe things which he has either done, taken in, retained, voided, or applied, during the diſeaſe.

2. This rule is of the utmoſt conſequence, and without it the deſcription of diſeaſes will be all obſcure and confuſed. For whatever is taken in or applied to the body changes it, and in its turn is changed by it; which changes we ſhould carefully diſtinguiſh, and not confound with thoſe which ariſe from the nature of the diſeaſe. For diſeaſes differ very much according to their different treatment. How greatly different has Sydenham obſerved the ſmall-pox to be when treated with the hot and cold regimen? how much worſe is every circumſtance in acute diſeaſes, when the patient can get no reſt? what irregular ſymptoms occur in diſeaſes from the imprudent application of cantharides, mercury, arſenic, *&c.* tho' uſed only externally? for all theſe do not act alone, but in conjunction with the diſeaſe; nor does the diſeaſe act alone, but in conjunction with them.

3. To

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(*a*) Epidem. Lib. I. Charter. Tom. IX, pag. 58.

3. To relate the advantages received from diet, ſurgery, or medicine, together with the true method of their being applied, juſt as either chance or art ſuggeſted them.

3. Every thing is to be candidly recited which has been obſerved to do good or ill in diet, ſurgery, or medicine; nothing is to be diſſembled. Hippocrates ingenuouſly (*a*) acknowledges his miſtake, when in a wound of the head he diſtinguiſhed not a ſtroke of a dart from a future of the ſkull; and many of the perſons died, whoſe diſeaſes he deſcribes in his diſcourſes of epidemic diſtempers; whereas moſt writers of obſervations relate only their good ſucceſs and conceal their ill.

4. To mark down the concluſions, which according to the directions given (13) may be rationally and fairly drawn from theſe three, as *data*, as ſo many ſafe rules of practice.

If now the Phyſician has faithfully obſerved the three foregoing directions, he may from theſe *data*, by juſt reaſoning, deduce the moſt unerring rules, which will immutably ſerve to direct him in his practice. Thus when we know by undoubted obſervations, that a quartan ague while it laſts keeps off the attacks of an epilepſy, nay ſometimes entirely cures it; we hence juſtly conclude, that a quartan coming on after an epileptic fit is to be left to itſelf, and by no means to be meddled with.

Whilſt Sydenham looked upon a new diſeaſe, as ſomething he had never been acquainted with before, he took notice that ſome of the applications made to his patients proved beneficial, and others prejudicial, that nature ſeemed to point out a particular courſe,

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(*a*) 5. Epidem. Charter. Tom. IX. pag. 340, 341.

and that by oppoſing this direction every bad ſymptom became worſe; and from hence he deduced the method of cure, in which he ſo happily ſucceeded, and by which he deſervedly obtained ſo great an authority in the profeſſion.

This fatigue of obſervation he was forced to undergo as often as a new epidemic conſtitution aroſe, which though it ſeemed enough to reſemble the former, yet if treated in the ſame manner was followed with very ill ſucceſs, as he ſo ingenuouſly confeſſes; and yet by this method of enquiry he diſcovered a new and certain method of cure.

Being thus forewarned therefore that there is often ſuch a difference in diſeaſes which appear alike, we are to ſearch out the hidden nature of diſeaſes by the rules here given, that we may be able to aſſiſt the ſick in a proper manner.

## SECT. XV.

THE multitude of diſeaſes make their due arrangement the more difficult.

Whoever is thoroughly acquainted with all the branches of knowledge, which are at this day diſcovered in the art, will find himſelf in no particular more at a loſs in deſcribing the hiſtory of diſeaſes, than in determining where he ought to begin, how to proceed, and where to end, and indeed even among the beſt authors we meet with different methods, ſome beginning with the formation of the chyle and its diſorders, and from thence proceeding to ſanguification; others running over the body from head to foot, and relating the diſeaſes of every part; but in all theſe methods there are great difficulties; the following paragraph ſeems to point out the order, which is moſt ſimple.

## SECT. XVI.

BUT it is moſt natural to treat them firſt, which are moſt thoroughly known. 2. which in their nature are moſt ſimple; 3. which are moſt eaſily cured; and 4, which are neceſſary to be known in order to underſtand others.

1. It is an eſtabliſhed rule in all ſciences to begin with ſuch particulars as in themſelves are moſt evident; and the geometricians, the beſt maſters of truth, by thus gradually proceeding from a few poſtulata, ſo clear, that no body in his ſenſes can doubt of them, have thence deduced an infinite number of the moſt beautiful propoſitions.

2. That would be the moſt ſimple diſeaſe (if there were any ſuch) which had one ſymptom only; for if another diſeaſe had two or three, it were proper to begin with the former as the moſt ſimple: for thus all regular ſcience proceeds from the moſt ſimple to the more compound.

3. That cure is to be called the moſt eaſy, which immediately diſcovers to the perſon conſidering the diſeaſe the neceſſary ſteps that lead to it, and which does not require any great application of art.

4. But we muſt be particularly careful that the diſeaſe be firſt explained, which is neceſſary to be known before others can be underſtood. In this place the celebrated author of theſe Aphoriſms uſed to tell his hearers, that having ſet down all diſeaſes in writing, he then applied to them theſe four rules, and thence drew the following concluſions.

## SECT. XVII.

BUilding therefore on this foundation (16) we ſhall proceed to treat of diſeaſes in the following order.

## SECT. XVIII.

WE ſhall begin with the ſeveral kinds of diſeaſes, that are moſt ſimple.

This follows of itſelf from what has been ſaid.

## SECT. XIX.

OF theſe therefore the diſeaſes of the ſolid parts require in the firſt place to be explained and cured.

For all diſeaſes are either of the ſolid or fluid parts, or of both together: but the nature of the fluids is much more intricate and compound than that of the ſolids; we are to begin therefore according to the fore-mentioned rules with the diſeaſes of the ſolids.

## SECT. XX.

OF theſe (19) the explication and cure of the diſeaſes of the moſt ſimple ſolid fibre ought to be the firſt.

Of all the ſolid parts of the body we can conceive none more ſimple than a fibre; for veſſels conſiſt of membranes and theſe of fibres: now a fibre is a part of the human body conſidered only as extended in length, but as having no parts in breadth, and may therefore be compared to a mathematical line, which is defined to be length without breadth: but let the length of the fibre be ever ſo great, it is ſtill conſidered as a moſt ſimple part, provided that all breadth be excluded.

# The DISEASES of a ſimple ſolid FIBRE.

## SECT. XXI.

THOSE parts which being ſecreted from the fluid contained in the veſſels, and applied to each other by the vital powers, and the aſſiſtance of a moſt fine aqueous or fat gluten, compoſe the leaſt fibre, are very ſmall, moſt ſimple, earthy, and ſcarce capable of being changed by any of thoſe cauſes, which are found to act in us during life.

The moſt ſimple fibre conſiſts of very ſmall parts adjoining to each other length-ways: theſe parts which are not diviſible into leſs are called the elements of the fibres. For by an element is meant every the leaſt part of that thing whereof it is an element *(a)*. A fibre that conſiſts of two ſuch elements or elementary particles adjoining to each other length-ways is the leaſt of all. One ſuch elementary particle conſidered by itſelf does not make a ſolid, but is ranked among the fluids; it is a combination of the elementary particles that conſtitutes a fibre.

How then are theſe fibres produced? Certainly an adult man, who weighs two hundred pounds, in his firſt original lay concealed in a very little drop of a ſeminal liquid, and from ſo ſmall a beginning growing up to ſo large a weight, owed all his increaſe in the ſolid parts to the ſupplies he received from the fluids, as appears from the obſervations of Malpighius, attempted of old by Hippocrates *(b)*, upon the incu-

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*(a)* Galenus de Hippoc. & Platon. placit. Lib. VIII. cap. 2. Charter. Tom. V. pag. 229.

*(b)* De natura pueri, cap. X. Charter. Tom. V. pag. 322.

incubation of eggs; in which we ſee the young chicken grows in one and twenty days, from too ſmall a bulk to be ſeen by the naked eye, to have very firm parts out of the liquid of the white attenuated by incubation.

But this liquid of the white muſt be yet farther attenuated and perfected by the organical ſtructure of the young one, before it can paſs thoſe veſſels, which by reaſon of their minuteneſs exceed all conception.

And yet this moſt ſubtle fluid was the vehicle to theſe elements of the ſolid parts.

From hence therefore it is reaſonable to conclude, that the particles which conſtitute a ſolid fibre are the ſmalleſt of all.

But they are alſo the moſt ſimple.] For if any thing could be conceived more ſimple, they would not be elements by the definition.

Earthy.] It may ſeem perhaps a bold undertaking thus peremptorily to pronounce what the nature of the body is, which conſtitutes the fibres. We call that earthy, which diſſolves not in water, nor melts by fire, but continues fixed. Now the ſolid parts of animals, after being deprived of all their more volatile parts by a chemical analyſis, yield at laſt juſt ſuch a ſubſtance. Does not putrefaction ſhew this, which in the moſt perfect manner ſeparates the earth from the other principles? a human body buried for ſome years, when taken up and ſurveyed, what does it exhibit? If it is not grown dry and hard, as is ſometimes the caſe, every part retains its original figure, ſo that even the face may be known; but with the leaſt ſhake the parts fall altogether, and nothing remains but a little very ſubtle earth to cover the bones, which generally remain firm ſtill. And theſe very bones, being long expoſed to the air, or burnt in an open fire, leave a mere earth behind, all the other parts being hereby diſſipated.

And ſcarce capable of being changed, *&c.*] The aſſayers, who prove metals by melting them with lead in a very briſk fire, make their beſt crucibles of this earth, which like a ſieve ſuffer the lead to paſs thro', and detain the more valuable metals. Is it credible now that theſe parts, which are immutable by this violent action of the fire, ſhould ever be changed by any cauſes known to act in us while we are alive? They may cohere to one another, and this coheſion may be diſſolved, and the particles in all other reſpects remain immutable.

It may ſeem ſtrange indeed, that ſo fixed and indiſſoluble an earth ſhould lie unſeen in the moſt ſubtle liquids. But chemiſtry ſhews us that this is poſſible. The moſt limpid ſaline alcaline ſpirits of animals, raiſed by fire, have earth in them: animal oils obtained by diſtillation, though very pure, leave ſome earth behind, whenever the diſtillation is repeated; and will at laſt fly off, when they have depoſited all their earth. For this earth it ſeems gives a ſtability to the other principles.

But in order that our ſolid fibres ſhould be compoſed of theſe earthy elementary particles, it is requiſite that they cohere together. This is wrought in us by the power of life applying new elementary particles to the fibres already formed in the places of thoſe that are carried off, and this we call nouriſhment: and ſo far as appears from the conſideration of the thing itſelf, though we do not yet perhaps know the true manner of it, this is effected by the interpoſition of an aqueous or fat gluten, for water hath an incredible power to unite bodies together. The powdered lime of alabaſter (which is called *gypſum)* is ſo light, that it may be diſſipated with the leaſt breath, but by mixing water with it, it is made into a ductile paſte, and this paſte in a little time hardens into a ſtone. Shells burnt to lime are capable of being ground into an extremely fine powder, which is often prejudicial to the lungs through its volatility and lightneſs; but if well mixed with water it becomes a paſte, which by fire may be turned into the hardeſt ſtone. Even in the moſt ſolid parts of animals, where none would ſuſpect there was any intermixture of water, it lies in an incredible quantity. Diſtil the dryeſt ivory or hartſhorn, which have lain ſeveral years in the ſhops, in a glaſs retort, and the greateſt part will become volatile, and paſs into the receiver, and thus a great quantity of an aqueous liquid is by this means obtained from it, whilſt what is left behind becomes brittle.

Was this the meaning of the wiſe Homer, when none of the Greeks accepting Hector's challenge to a ſingle combat, he makes Menelaus in a rage imprecate as it were annihilation, and ſay *(c)*.

> Ἀλλ' ὑμεῖς μὲν πάντες ὕδωρ καὶ γαῖα γένοισθε.
> *To earth and water may you all be turn'd.*

But the ſame coheſion of the earthy parts may be effected by means of a fat gluten, as we learn alſo from chemical experiments. For as long as that laſt oil adheres to the parts of animals, which is not to be ſeparated but by the force of fire in the open air, they ſtill cohere; but this being expelled they fall aſunder. Bones calcined and made very brittle, if dipped in oil, will cohere again.

## SECT. XXII.

IN theſe elementary particles therefore (21) ſeparately conſidered, no diſeaſe has ever been deſcribed, as obſerved or cured by Phyſicians.

If now theſe leaſt elementary particles, which conſtitute by their union the moſt ſimple fibre, be conſidered apart by themſelves, we know nothing that can be affirmed of them: and they who by ſubtle ſpeculation have attempted to diſcover the diſeaſes to which they are ſubject, have hitherto ſaid nothing to the purpoſe. That they may break off from one another and have their coheſions changed, is what we eaſily con-

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*(c)* Homer. Iliad. Lib. VII. ver. 120.

conceive; but the ſame face of things conſtantly perſevering for the ſpace of 6000 years, makes it highly credible, that the elementary particles of bodies are abſolutely unchangeable.

Theſe elementary particles of the ſolid parts may be conſidered, either as being contained in the fluids and with them flowing through the veſſels, and then their diſeaſes, were they known, would be the diſeaſes of the fluids; or elſe as when united they compoſe a ſolid part; but then they are no longer elements, but a ſolid compoſed of the elementary particles.

## SECT. XXIII.

BUT in the ſmalleſt fibre, formed by the (21) union of theſe elementary particles, the following (24 to 38) moſt ſimple diſeaſes deſerve to be conſidered: for they frequently occur and lay the foundation for the underſtanding of others, though frequently overlooked or not well underſtood.

The moſt ſimple diſeaſes of all therefore are not to be ſought for in any default of the elementary particles, but in the leaſt fibre made by the uniting of theſe together. For if but two elementary particles cohere together, their different coheſion may cauſe a diſeaſe; and as will be ſhewn hereafter, the too great or too little coheſion in the ſimple ſolid fibres, and in the veſſels and viſcera formed from them, may give riſe to innumerable diſeaſes.

Now theſe diſeaſes have been generally over-looked; for even the Methodiſts, as they are called, who are reputed the authors of the doctrine of aſtriction and laxity, have never treated of theſe.

This appears from the account of their doctrine given by Celſus (*a*). *Satis eſſe credebant*, ſays he, *communia*

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(*a*) Lib. I. in præfatione, pag. 15.

*munia morborum intueri, & quidem horum tria genera eſſe; unum adſtrictum, alterum fluens, tertium mixtum. Nam modo parum excerne ægros, modo nimium; modo alia parte parum, alia nimium*; "they judged it ſufficient to conſider ſome of the common properties of diſeaſes, which they made to be threefold, the one bound, another looſe, and the third mixed; for at ſome times the excretion of the diſeaſed," they ſaid, "was too little, at other times too much; ſometimes there was too ſmall a diſcharge in one part, and in another too large."

## The DISEASES of a weak and lax FIBRE.

### SECT. XXIV.

THE weakneſs of a fibre is the union of its minuteſt parts (21) with ſo ſmall a degree of coheſion, as to be capable of being diſſolved by that light motion which is the effect of health, or by a motion, which does not much exceed it.

Whatever be the cauſe of the coheſion of the elementary particles which conſtitute a fibre, it will eaſily be conceived, that the force with which they cohere may be increaſed or diminiſhed. Our veſſels compoſed of theſe fibres ought to yield to the impulſe of the liquids contained in them and be diſtended, yet not beyond certain limits; the coheſion ought ſtill to remain without a rupture. There is therefore required a certain and determinate degree of coheſion in theſe fibres, which if it be increaſed or diminiſhed will conſtitute a diſeaſe.

The weakneſs therefore of a fibre can never be defined, otherwiſe than relatively: for in the firſt weeks after conception, thoſe firſt rudiments of the human body are ſo ſoft as to melt between the fingers, and if they were not ſuſtained by the equable preſſure of the ſurrounding fluid, would fall into a ſhapeleſs mucous maſs. So ſmall is the coheſion required in the fibres at this time: and yet how great a ſtrength of coheſion is requiſite in the fibres of adult perſons?

In different parts of the ſame body alſo there is required a very different degree of coheſion. The coheſion of the ſmalleſt ſolid particle, which forms the ſoft pulp of the auditory nerve, is ſurely much leſs than of that which conſtitutes the hard tendon, which is called the tendon of Achilles.

Hence therefore a ſolid fibre is then ſaid to be too weak, when it cannot without injury to its coheſion ſuſtain that motion, which is requiſite in health to the exerciſe of the functions.

Neither is this altogether ſufficient, they ought alſo to have ſtrength enough to ſuſtain a force ſomewhat greater. For if theſe minute ſolid particles cohered with no greater force than barely to ſuſtain the gentle motion of the liquids through the veſſels in health and no more, their coheſion would preſently be deſtroyed, when the liquids were propelled through the veſſels with a greater momentum by any increaſe of the circulation. For the velocity of the circulation is increaſed by very ſlight cauſes, and ſuch as no human prudence can avoid; as upon a ſudden noiſe the heart preſently falls into a palpitation, and all the arteries beat very ſwiftly; ſo laughing, coughing, ſneezing, will all very much accelerate the motion of the blood.

In diſeaſes we ſometimes ſee the unhappy condition man is reduced to, who has his ſolid fibres ſo weak, as to be but barely able to ſuſtain the moſt gentle motion.

Such perſons as ſpit blood through the breaking of an artery in weak lungs, will live tolerably eaſy, if they keep themſelves quiet, if the quantity of blood diſtending the veſſels be leſſened by bleeding, and they take in no diet capable of exciting any violent

motion

motion or irritation; but if any violent fit of coughing ſeizes upon theſe unhappy people, or they imprudently bawl out aloud, or are agitated by any ſtrong paſſion, and thus the impetus of the blood paſſing through the lungs be increaſed, the too tender pulmonary veſſels are by this means burſt, and the blood ruſhing out into a ſtream very frequently carries them ſuddenly off.

## SECT. XXV.

THE antecedent cauſes are; 1. An imperfect converſion of the food into a like nature with that of an healthy vital liquid, which is owing to a too great deficiency of the proper digeſting humours, and the ſluggiſh action of the ſolids upon the liquids, or to a naturally greater tenacity in the food than the powers appointed to change it in the body are able to conquer. 2. Too weak an application of one part (21) to another, which is cauſed by too weak a motion of the liquids, and this generally by a defect in the motion of the muſcles. 3. Too great a diſtenſion of the fibres ſo as to be upon the point of breaking.

1. It is a moſt certain truth that we conſiſt of the things we are nouriſhed by; but the matter which nouriſhes muſt undergo a preparation in the body before it can nouriſh; ſo that food alone is not ſufficient for this purpoſe, as was obſerved before in the explication of the firſt aphoriſm; there is beſides required a healthful ſtate of the natural functions in order to produce this aſſimilation of the food into our nature, and reſtore what has been carried off by the activity of life. Some Phyſicians have wondered why when they ordered the moſt nouriſhing food in a deſperate conſumption, it ſhould be attended with no benefit;

nefit; but the reaſon is, that in this caſe the aſſimilating power is wanting, without which no nouriſhment can be obtained. Galen therefore deſervedly blames the Phyſicians who did not attend to this, (*a*) who were Methodiſts in name indeed, but in their actions wanted all *juſt* method (ἀμέθοδους), ſince they gave fleſh and wine, *&c.* in ſuch caſes, and ſo poured nouriſhment as it were (εἰς ἄψυχον ἄγγος) into a lifeleſs veſſel.

Which is owing to the too great deficiency of the proper digeſting humours.] If we conſider the ſeveral circumſtances intervening before the crude food is converted into our own nature, we ſhall ſee that an incredible quantity of human liquids is mixed with it. While it is chewing, the ſaliva and mucus of the mouth, the tongue, the palate, the jaws, *&c.* in the ſtomach the gaſtric juice, and in its paſſage thence the two ſorts of bile, and the pancreatic juice, and in every point of the inteſtines freſh humours already perfected by the organs of the body; when the chyle is received into thoſe fine tubes, the lacteals, it is diluted with a prodigious quantity of lymph in the thoracic duct, the lymph returning from almoſt every part of the body is poured into it; from whence the chyle paſſing by drops into the ſubclavian vein, is ſwept away and ſwallowed up by the whole torrent of the blood. Hence therefore we may juſtly conclude, that among the principal cauſes of aſſimilation, is to be reckoned the mixture of a little crude aliment with ſo large a quantity of concocted humours.

This truth is farther confirmed by experience. For when the blood of the moſt robuſt ſoldiers is in great meaſure drained off by their wounds, though they ſwallow down their food with greedineſs, they ſhall yet not be able to digeſt and convert it into good blood, but the whole contexture of the body being hereby weakened, they ſhall languiſh and be drowned in a dropſy.

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(*a*) De ratione victus in morbis acutis ex Hippocratis ſententia, cap. IV. Chart. Tom. XI. pag. 189.

In abortions where there has been a conſiderable loſs of blood, how great a languor follows thereupon and of how long continuance!

All the other evacuations in exceſs by ſtool, urine, ſweat, *&c.* produce the ſame effect.

To the ſluggiſh action of the ſolids on the liquids.] When freſh chyle mixed with the blood, has for ſome time been acted upon by the arteries of the lungs and of the whole body, it acquires the nature of milk. But milk approaches nearer to our nature than chyle. After a long time, as Lower *(b)* has ſhewn, it puts on the nature of ſerum. But during all this while it endures the action of the veſſels on the liquids, which conſiſts in the re-action wherewith our veſſels repreſs the diſtending fluid. The firmer therefore theſe veſſels are (provided they be not too rigid to yield to the impulſe of the liquids) the greater is their action, and ſo much the ſooner and better is the food aſſimilated into our nature.

A weakly girl languiſhing under a chloroſis, takes in aliment indeed, but does not convert it into good blood, only into milk as it were, from whence ariſes the univerſal paleneſs; nay, when a vein has been unadviſedly opened in this caſe, I have ſeen white blood flow from it; if a perſon under this complaint increaſes a little more in ſtrength, the aliment is more changed, yet not perfectly elaborated; then the colour becomes yellow or greeniſh. The cauſe of all is the defect of the action of the ſolids on the fluids, whence theſe perſons ſwell, and are filled with crude humours, and are not well nouriſhed.

Let the force of the firm parts on the contained fluids be increaſed by ſteel and bodily exerciſe, and the tumid face ſhall begin to ſubſide, the lips and cheeks become tinctured with the colour of the lovely roſe, and the wonted vigour return to the whole body;

Or to a naturally greater tenacity, *&c.*] The mixture of a very large quantity of concocted humours with

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*(b)* De corde, pag. 239.

with a very little crude chyle, and the action of the ſolid parts on their contained fluids, have been aſſigned as the principal means that conſpired to change the crude food into our ſubſtance. But though their action be ſo efficacious as at laſt to produce human blood out of ſo many different ſorts of aliment; yet there is required in the aliment itſelf a diſpoſition to be ſubdued by the changing powers of our body. (*c*) *Ipſa enim concoctio eſt in coquentis ſubſtantiam* (οὐσίαν) *deductio quædam ejus, quod concoquitur; corpore igitur ſecundum naturam habente, quando & concoquendum familiarem habuerit naturam reſpectu coquentis, mutatio & alteratio totius ſubſtantiæ coquendæ fit, aut maximæ ejus partis, pauciſſimo nobis immorante ſemicocto*; "for concoction itſelf is a "ſort of reduction of that which is concocted into "the ſubſtance of that which concocts. When the "body therefore is in a perfectly ſound natural ſtate, "and the nature of the food to be concocted has a "proper affinity with that which is to concoct it, "then follows a change and alteration of the whole "ſubſtance of the food, or at leaſt of its greateſt "part, very little remaining half concocted."

In ſieges, where people are forced by famine to eat any thing they can find, they all grow weak and languid. Thus when for want of proviſion "at Middle-"burgh in Zealand (*d*), they lived on bread and cakes "made of linſeed, the hypochondria were very ſoon "hereby diſtended, the face, and other parts, became "ſwollen, inſomuch that many died of the diſtemper." The reaſon was, that the invincible gluten of the linſeed could not be converted into proper nouriſhment.

When girls through a depraved appetite take to eating ſand, lime, wool, and other ſuch traſh, how weak and pale they grow!

The tenacity of our food therefore ought to be proportioned to the aſſimilating powers; otherwiſe the body will be oppreſſed and not repaired thereby.

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(*c*) Galen. Comment. 2. in Epidem. 1. Chart. Tom. IX. p. 55.

(*d*) Dodonæi Stirp. hiſtor. pag. 534.

When the poorer people give their tender infants unfermented farinacious cakes, potatoes, *&c.* theſe poor children have their bellies ſwell immoderately, while all the reſt of their body grows leſs.

It was with a view to this, that Hippocrates (*c*) ordered the uſe of a very light food, while a diſeaſe continued in its full ſtrength; for nature being then oppreſſed by the force of the diſeaſe, he knew, was not able to digeſt properly food that was ſtronger; and from this principle he deduces in another place many ſalutary rules of diet.

2. When a very healthful perſon is drowned, his ſolids and fluids continue as before, yet is there no aſſimilation, nor is any fibre nouriſhed; the reaſon is, becauſe the power of life is wanting to diſtribute, move, and apply. For though ſuch food be taken down, as ſhall conſiſt of particles proper to reſtore the fibres, yet if theſe be not applied and fixed by the power of life, no nutrition will follow.

In thoſe diſeaſes where the vital circulation of the humours is languid, though you give the moſt nouriſhing food, it is to no purpoſe; you may cram ſuch bodies 'till they ſwell and are overcharged, nay almoſt ſuffocated; but you cannot nouriſh them, as we ſee in the caſe of a dropſy.

Now the diminution of the velocity in the circulating fluid, is the chief reaſon why the elementary particles are juſtly applied ſo as to procure the nouriſhment of the fibre.

But the origin and fountain of the vital motion ſeems to reſide in the heart, by whoſe motion the blood being driven out of the ventricles of the heart, all the arteries are dilated, which ſoon after contracting again, perpetuate the motion of the blood that was driven into them.

Now one of the principal cauſes of the motion of the heart, perpaps, is the influx of the venal blood into its cavities; for long after death, if the venal blood

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(*c*) Aphor. 8. Sect. 1.

be protruded towards the right ventricle of the heart, its motion returns, as appears by moſt certain experiments. But when the muſcles act, they by their ſwelling compreſs the adjacent veins, and ſo accelerate the motion of the venal blood towards the heart; and the heart hereby irritated is contracted more ſwiftly, from whence ariſes a quicker circulation of the blood.

This is confirmed by moſt certain experience. If two brothers born of the ſame parents fall into a different courſe of life, and one applies himſelf to the ſtudy of Philoſophy and lives a ſedentary life, whilſt the other adds firmneſs to his body by hunting, riding, and warlike exerciſe, what a vaſt diſparity may we obſerve in their ſtrength? The former like a puny girl is weak and ſickly; whilſt the other, who has enured his body to labour, ſhall acquire by this means very near the ſtrength of an Hercules.

Let an horſe that has been daily uſed to ſtrong exerciſe ſtand quiet in the ſtable, and he ſhall ſoon grow plump and ſleek with fatneſs, but at the ſame time he will become much weaker, and altogether unable to undergo his uſual labour.

Reſt makes the body moiſt and weak; labour makes it dry and ſtrong (*f*).

3. Nothing ſhews the impoſſibility of explaining the nature of particular bodies by mechanical principles more than coheſion, that wonderful property of bodies. The parts of iron cohere together, that iron is drawn into wire fit for the ſtrings of a muſical inſtrument; by turning the ſcrew this wire is drawn longer and finer, and of courſe fewer particles muſt touch each other; ſtrain it ſtill farther and at laſt it ſhall break, but though you put the broken ends together they will never after cohere. So that coheſion may by degrees be ſo diminiſhed, as at laſt to become none at all, and ſo the moment before the wire broke the coheſion was ſcarce any, or at leaſt ſo inconſiderable, as

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(*f*) Hipp. de victus ratione ſanorum, Lib. II. cap. 10. Charter. Tom. VI. pag. 474.

as to admit of a ſeparation upon the intervention of the leaſt external force; and the caſe is the ſame with our ſolid fibres.

One way of torturing malefactors to make them confeſs, is to hang weights to their great toes, and gradually increaſe them. Such perſons as have ſuffered this puniſhment for ſome days ſhall ſcarce be able to move their limbs, but become in a manner paralytick purely from this diſtenſion.

The bladder, when ſtretched beyond its tone by a retention of urine, ſhall loſe its power of contracting: the ſkin and *panniculus adipoſus* in the abdomen of a pregnant woman ſhall contine flaccid and wrinkled all her life, though the fœtus which diſtended it be excluded.

## SECT. XXVI.

THE effects it produces are the eaſy extenſion of the veſſels compoſed of theſe weak fibres (24), their rupture or ſluggiſh action on their contained liquids; whence tumours from their diſtending liquids, putrefaction from the ſtagnation or extravaſation of them, and then the numberleſs other conſequences which follow from theſe.

This will clearly appear, if we ſuppoſe a human body that is in perfect health to be at once made too weak in all its ſolid fibres: now as all our veſſels conſiſt of fibres contorted and wove together, the ſtrength of all the veſſels depends on the ſtrength of theſe fibres; but the greater or leſs capacity of every veſſel is computed in a compound ratio of the force of the impelled liquid directly, and the reſiſtance of the ſides inverſely; when therefore the fibres which conſtitute the ſides of the veſſels are weakened, and the reſiſtance of the ſides is hereby leſſened, while the force of the liquid impelled remains the ſame, the veſſels muſt neceſſarily be diſtended.

If any part of the body, ſuppoſe the foot, be expoſed to the vapour of warm water, than which nothing weakens more, it will ſoon begin to ſwell and become œdematous.

If the ſame cauſe proceeds to weaken the fibres, the leaſt force will at length deſtroy the coheſion; *i. e.* make a rupture; as we often ſee in the unhappy caſe of tender conſtitutions, where an artery ſhall burſt in the lungs by ſo ſmall a circumſtance as coughing, ſinging, or calling aloud.

Sluggiſh action on the contained liquids.] The arteries, when diſtended by the impelled liquid, repreſs the fluids by the force of their own fibres; and by this endeavour of the fibres to diminiſh the capacity of the veſſels which they conſtitute, they preſs the liquids contained in them, ſtrike forcibly upon them, and change them; and on theſe two actions depends whatever is wrought in the body. When therefore the ſtrength of the fibres is diminiſhed, it plainly appears, that the action of the veſſels which are compoſed of them upon the fluids contained in them muſt likewiſe be leſſened.

Tumours from the diſtending liquids.] The reaſon has been already given, and ſtands confirmed by moſt certain obſervations. When a tender maid begins to be debilitated in a languiſhing chloroſis, firſt thoſe very lax places under the eye-lids (called by the antient Greeks ὑπώπια, ὑποφθάλμια) begin to ſwell, next the whole face appears to be ſomewhat bloated and pale; and as the maſs of humours to be moved daily increaſes, while the moving cauſe is not increaſed, ſhe begins to ſwell all over in almoſt every part of the body. Thus in the beginning of a leucophlegmatick habit, men are often pleaſed to think they are perfectly well and grow fat. When the air has continued muſty for ſeveral days together, the bodies of all perſons whatſoever ſeem inflated, becauſe the external parts in this caſe lying in a kind of perpetual bath are thereby relaxed, and yield to the diſtending liquids.

Putrefaction, *&c.*] So long as the humours circulate through the veſſels with an equable motion, no putrefaction is bred in the body; whatever is diſpoſed to putrefy being carried off by the uſual emunctories. But when the debilitated ſolids can no longer propel the diſtending fluids, a ſtagnation follows; and as all animal liquids will putrefy, when left to themſelves, in the heat of common air, (except only milk, which has not yet acquired all the properties of an human liquid, and perhaps the fat) much more will they be apt to putrefy when expoſed to the heat of our bodies, which always exceeds the heat of the common air: ſo alſo in the caſe of a ruptured veſſel and an extravaſation of humours.

If now we apply theſe obſervations to the various parts of the human body, we ſhall find that numberleſs and moſt grievous evils take their riſe from this ſimple cauſe.

If the lungs be too tender to bear the force of the blood that is driven from the heart, the veſſels will burſt and bring on a ſpitting of blood, from whence ſo often follows an incurable conſumption.

If the veſſels of the brain ſhould chance to grow weak, and be either too much diſtended, or burſt and extravaſate their humours, every diſeaſe of the animal functions may follow upon it, from the lighteſt vertigo to a mortal apoplexy. And ſo of the other viſcera; but theſe examples may ſuffice.

## SECT. XXVII.

FROM the three foregoing Sections (24, 25, 26) the preſent, future, or paſt debility of the fibres is known: the effect is foreſeen; and what is required to work a cure evidently diſcerned.

Whoever therefore underſtands thoroughly what has been already ſaid concerning the nature of a ſimple fibre when too weak, what it is that precedes this weakneſs, the appearances which diſcover it, and the effects which follow it, will eaſily be able to determine whether the fibres of his patient be too weak or not. This in phyſic is termed the *diagnoſis*, or clear notion of the preſent diſeaſe, as abſolutely diſtinct from every other diſeaſe; and comprehending in it the individual nature of the diſeaſe. This diagnoſis is acquired by knowing firſt, that ſuch phyſical cauſes have preceded, as have ever been found before to give riſe to this diſeaſe. For inſtance, if a man of naturally a weak conſtitution has accuſtomed himſelf to bathing in warm water, to the drinking of ſmall liquors warm, and farther indulged himſelf in ſloth and inactivity, then I know that ſuch cauſes have preceded as render the fibres weak; and this is the firſt foundation of a diagnoſis. The other is the knowledge of the diſeaſe conſidered in its own nature and preſent effects; which if they appear to the ſenſes become the object of their obſervation; but in caſe of a more latent diſeaſe, its nature is diſcovered by knowing the effects which proceed from it as a cauſe; whoever therefore knows the effects of a weak fibre, will be able to diſcover whether the diſeaſe before him be this diſeaſe or not.

*Prognoſis* ſignifies the knowledge of a thing before it happens. It is therefore the knowledge which the Phyſician has in his mind of ſome diſeaſe that will certainly be, which as yet is not. A diſeaſe is known to be future by our knowing that ſuch cauſes have preceded, as, though they cannot of themſelves produce the diſeaſe, yet will do it when increaſed or joined with others. For inſtance, if a Phyſician knows that a man is conſtitutionally inclined to a ſpitting of blood, he will put him in mind that he has cauſe to fear this diſeaſe may come on, though he has never yet had it; he will bid him be careful not to drink too much wine, or take down too many ſpices, to avoid ſpeaking aloud, ſinging, *&c.* for the prognoſtick is not to be drawn from the knowledge of a cauſe already perfectly formed in the patient, for then the diſeaſe would be preſent, but from the knowledge of ſome phyſical cauſe, which pre-diſpoſes to ſome certain diſeaſe as a part of the total cauſe; to which the Phyſician foreſees another cauſe may ſoon be added, which will render the former pre-diſpoſing cauſe compleat. Thus when a man lies ſick of a pleuriſy, and a prognoſtick is required of the Phyſician, and he ſees the diſtemper is not attended with immediate danger, yet that it is not carried off by nature, nor the material cauſe of the diſeaſe expelled by any critical evacuation or tranſlation, and withal, that the medicines which have been applied have not proved effectual, he will then prognoſticate that this pleuriſy will end in a ſuppuration; and this prediction ſhall not be derived from the preſent pain of the patient, but from this circumſtance joined with ſuch cauſes as occaſion an inflammation to end in a ſuppuration.

And thus we may clearly underſtand, what is meant by diagnoſticks and what by prognoſticks.

If then the alterations which a diſeaſe, whoſe diagnoſtick ſigns are thoroughly known, has wrought in a body that before was in health, be carefully obſerved, I am able from the ſeeing of theſe alterations wrought in the body of my patient to pronounce, that he labours under this diſeaſe. This judgment is termed ἀνάμνησις, or a *recollection* of the diſeaſe.

What is required to work a cure.] This is the great end propoſed by the art: for the cure is ſo to change the preſent phyſical condition of the body, on which the diſeaſe depends, as to reſtore the injured functions to a ſound ſtate, and at the ſame time to preſerve life.

For when from the diagnoſticks of the diſeaſe we have learnt its particular ſtate, increaſe, *&c.* the part, affected and the matter that offends in the ſaid part, and have formed a prognoſtick, what is to be hoped for and what to be feared; and then too from all theſe concluded what things are to be done : theſe are called the things *indicated*, and the knowledge thus produced in the Phyſician's mind is termed the *indication.*

And here firſt we are always to conſider whether the diſeaſe be to be left to nature, or whether any aſſiſtance is to be given by art ; for as the ſick man lives, and many things will be wrought in him by means of the life remaining, which are not yet wrought, if the changes which life of itſelf will make be ſuch, as from certain obſervations are known to be capable of altering the cauſe of the diſeaſe, in ſuch manner as health ſhall return, then is nothing to be done. For example, if a pleuritick perſon in the firſt ſtage of the diſeaſe coughs up a mucous yellow matter ſtreaked with blood, and finds relief in every ſymptom, we know from the faithful obſervations of the Antients, that if this expectoration can be kept up, he will be well in a few days ; for which reaſon we are not to diſturb this ſalutary attempt of nature, by bleeding or any other remedy, but are only to throw in ſuch very ſmooth decoctions, as may ſerve to ſupport this expurgation. But if, for example, in a pleuritick patient we obſerve a violent fever, a burning heat, a dry cough, attended with a dryneſs of the tongue, and no ſign appears, from whence we may learn that nature is aiming at any ſalutary change, we then know, that if things go on in the body as they do, either a mortal gangrene will follow ; or if the diſeaſe be of a milder nature, a ſuppuration, which is always a good circumſtance where the ſuppurated matter can be carried off ; but here lies the danger, leſt the purulent matter when formed ſhould be diſcharged into the cavity of the thorax, and deſtroy the patient with a fatal empyema : here then we conclude that nature is not to be left to itſelf, but the diſeaſe is to be ſo changed by the powerful aſſiſtance of art, as to prevent either a ſuppuration or gangrene ; what theſe aſſiſtances are will appear from a knowledge of the nature of the diſeaſe and its preceding cauſes.

SECT.

## SECT. XXVIII.

THIS cure will be obtained; 1. By nutriment, in which the matter deſcribed (21) abounds, and which is already prepared almoſt in the ſame manner, as in a ſtrong and healthy body, of which ſort chiefly is milk, eggs, broths, panada, or decoctions of well fermented bread and rough wines. Theſe are to be taken in a ſmall quantity, but often; 2. By increaſing the motion of the ſolids and fluids, by frictions, riding on horſeback or in a chariot, ſailing, walking, running, and all bodily exerciſes; 3. By a gentle compreſſure of the veſſels, and a moderate repelling of the liquids contained in them; 4. By medicines, both acid and auſtere, or even ſuch as are ſpirituous and fermented, uſed cautiouſly and with moderation; 5. By any means, that will remove the too great diſtraction of them.

It is here ſuppoſed that there is no other defect in the body, but meer weakneſs of the fibres; ſo that we now conſider this diſeaſe abſtractedly from all others. Now we cannot eaſily cure the too great weakneſs of the preſent fibre, ſo as to reſtore it to ſuch a degree of ſtiffneſs, as is required in a healthful ſtate, but we can ſupply ſuch elementary particles for the formation of the fibres, that according to the laws of the human fabrick are hereafter to be framed, as ſhall ſuffice to give them a due degree of ſtrength.

The firſt cauſe mentioned of the too great weakneſs of the fibres, was the imperfect aſſimilation of the crude aliment into the ſubſtance of the laſt concocted matter, which is the moſt ſubtle of all others, and runs in the ſmalleſt veſſels. Now to make the fibres ſtrong there is required a ſubſtance proper to be applied to them: but this is ſuch a ſubſtance as having undergone the action of all the viſcera and veſſels according to the laws of a healthful body, has acquired the laſt and moſt finiſhed degree of perfection: but as the fibres are now ſuppoſed to be too weak, and the action of all the veſſels on their contained fluids depends on the due ſtrength of the fibres, the ſeveral functions employed in changing the crude aliment into our nature will be leſs able to diſcharge their office, and conſequently the laſt concocted matter ſubſervient to nouriſhment in ſuch a body will not be duly prepared. For this reaſon it is, that Phyſicians often wonder, why very good food given to a man in this weak ſtate does not procure proper nouriſhment; but as this food only ſupplies the remote matter, out of which the vital functions are to form nouriſhment, when theſe functions are injured, let the food be ever ſo good, it is given in vain.

While the tender embryo lies in the mother's womb, it is nouriſhed by the humours which have been prepared by the mother; for ſo weak a little body could not draw its nouriſhment from any other body leſs aſſimilated. When it is born the milk ſupplies it with humours prepared in the body of its mother. And thus the medicinal art, in imitation of the method purſued by nature, appoints ſuch nouriſhment for weak bodies, as is already prepared in the body of ſome healthful animal, of which the principal is

Milk.] Every man is nouriſhed by milk peculiar to himſelf, and from this only by the vital powers are all the other ſolids and fluids perfectly formed. This milk we find in men as well as in women; and in the latter, though they have never had a child or given ſuck. We have accounts that (*a*) milk was drawn from the breaſts of a man of ſixty years old by ſuction only; as alſo from the breaſts of a woman who had never been

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(*a*) Miſcell. Cur. Dec. II. An. 5. pag. 60. Append.

been with child (*b*). This milk is the chyle, which after it has undergone the action of the heart, lungs, and arteries, and been mixed with all the other humours, has at length been ſeparated from them by the wonderful fabrick of the glands of the breaſts.

Of the ſeveral kinds of milk, the beſt of all for this purpoſe is human milk, as being moſt analogous to our nature, and is therefore always to be preferred to that of all other animals. It ſhould be the milk of a ſound woman, who uſes due healthful exerciſe, and a laudable diet, and is now in the perfect flower of her age, and is in the beſt ſtate, if drawn about four or five hours after eating; for by that time the chyle is changed into concocted milk, has loſt the nature of the aliments, and begun to aſſume our own. For there is a great difference of milk according to the different times of its being drawn after eating; that which comes into the breaſts as ſoon as the meal is over, is crude, and retains too much the nature of the nurſe's food; that which is drawn twelve hours after is thin, begins to be yellowiſh, and has a kind of urinous ſmell, not much unlike the ſerum of the blood; and conſequently that milk is beſt, which is drawn in the intermediate time.

But there is another thing here principally to be obſerved, which is, that all animals, which are nouriſhed by the milk of the dam, ſuck it from the teat, ſo that it is never expoſed to the air, but is given to the tender animal enriched with all its moſt ſubtle parts. For there ſeem to be in the milk ſome of the moſt ſubtle ſpirits elaborated by the laſt concoction of a healthful body. This appears from the concurrence of ſo many nerves in the parts where the chyle and milk are formed, from that moſt ſubtle dew which exhales from milk newly drawn whilſt it is yet warm, and from thoſe wonderful changes which have been obſerved in tender infants to have been occaſioned by the milk: thus I have ſeen an infant, that by ſucking its nurſe when ſhe was in

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(*b*) Miſcell. Cur. Dec. I. An. 3. pag. 12.

in a violent paſſion, thrown into convulſions, though before it was perfectly well.

Beſides, it has been the practice of Phyſicians from the earlieſt ages to endeavour to reſtore thoſe that were ready to die through weakneſs by introducing the effluvia, which exhales from the pores of an healthful young perſon, into the pores of the weakly and decrepid, by laying them together in the ſame bed. Thus was the body of David, when worn out with age, cheriſhed by lying in the ſame bed with a very healthful young woman (*c*). If therefore milk be given quite cold, or even after it has been warmed again, then that fine ſubtle part, which is the moſt wanted, will all be loſt.

For this reaſon Galen writes thus, (*d*) *Veteres vero etiam mulierem lactantem illis, qui tabe decumbebant, adſtare voluerunt, quorum ſententiæ & ipſe quoque accedo, & quod familiare id ſit, & quod priuſquam ambiente aëre refrigeretur, id ſumi voluerint.* "The Antients adviſed conſumptive perſons to have a nurſe, who gave ſuck, always by them, which is a practice that I entirely approve of, both as the milk is a kind of food that is moſt natural to us, and as they would have it given before it is cooled by the circumambient air."

And again, after a reſembling diſcourſe, he compares milk (*e*) *Semini genitali, quod nec ipſum aliquamdiu extra propria vaſa, ſi modo ſuam virtutem ſervabit, morari patitur, ſed vel in maris partibus contineri, vel fœminæ partes tangere debet: & ſane optimum lac eſt, ſi quis ex ipſis mamillis extraxerit,* &c. "To the genital ſemen, which will not admit of its being detained out of its proper containing veſſels, without loſing its virtue;" and adds, "that the milk is beſt when drawn immediately from the breaſts." After this ridiculing the opiniatrety of ſome others he ſays, *Quod*

*cum*

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(*c*) 2 Kings, cap. 1.

(*d*) Method. Med. Lib. V. cap. 12. Charter. Tom. X. pag. 123.

(*e*) Method. Medendi, Lib. VII. cap. 6. Charter. Tom. X. pag. 160.

*cum exhibere ſibi, ceu pueris, plerique recuſent, utique ceu aſinis ipſis dare aſininum convenit*; "But as many perſons do not care to take it, becauſe they will not be treated like children, it is fit truly that ſuch aſſes ſhould have aſſes milk given them in its ſtead."

This is farther confirmed by numerous obſervations. Capivaccius ſaved the only heir of a very noble family, by ordering him to lie between two nurſes in the flower of their age, and ſuck their breaſts.

A youth at Bologna labouring under a true maraſmus, lived upon the milk of a very beautiful young nurſe, who lay in the ſame bed with him, by which means his emaciated body was ſo well reſtored, that his friends became apprehenſive, leſt he ſhould loſe his ſtrength, he had gained from her milk, by an unſeaſonable venery (*f*).

Where human milk is not to be had, the next beſt is aſſes milk, then goats milk, and then cows milk.

Eggs] which incloſe ſo many wonders under their brittle ſhell, and by the obſervations of Malpighius, have given ſo much light into the generations of animals, are likewiſe uſed to this purpoſe.

The white of an egg, agreeing in moſt of its properties with the ſerum of human blood, contains in it a liquid, which from the warmth of one and twenty days incubation is ſo far changed, as to furniſh matter for the vital ſtamen, lying hid in the *ſacculus colliquamenti*, to increaſe to the ſize of a chicken; for the yolk is not conſumed, the white only ſeems ſubſervient to the nouriſhment of the young one in the egg.

For this reaſon it is juſtly affirmed to contain the beſt ſort of nouriſhment. Hippocrates ſaid (*g*), *Volucrum ova validum quid & nutriens & inflans habent; validum quidem, quia animalis generatio eſt; nutriens, quia lac eſt pulli; inflans, qui ex parva mole in multum diffunduntur*;

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(*f*) Foreſti obſervat. Tom. I. Lib. IV. pag. 152.

(*g*) De ratione victus ſanorum, Lib. II. cap. 5. Charter. Tom. VI. pag. 469.

*tur*; “That the eggs of birds have in them ſomething “ſtrong and nouriſhing and filling; ſtrong, becauſe “they are an animal offspring; nouriſhing, becauſe “they have the milk of the young contained in them; “and filling, becauſe from ſo ſmall a ſize they are “ſpread into ſo large a bulk.”

For this reaſon therefore the white of the egg is principally recommended for the nouriſhment of weak perſons; but diluted with water to take off from its tenacity, and ſeaſoned with a little ſalt or ſpice that it diſpleaſe not by its inſipid taſte. It muſt be diluted with water that is warm, for by the heat of boiling water it coagulates into a ſolid maſs that is hard of digeſtion.

This, however, falls far ſhort of the uſefulneſs of milk; for before the white of the egg can nouriſh the young, it muſt be acted upon by the veſſels and viſcera; whereas there are in milk moſt ſubtle humours already prepared by the animal machine.

But the yolk, though it yields a very good ſort of nouriſhment, requires a greater firmneſs of the viſcera; for as Harvey (*h*) has well obſerved after Ariſtotle, for ſome days after it is hatched, the young chicken is nouriſhed by the yolk that is contained in its own belly; for the white is conſumed during the time which paſſes whilſt it is growing from an inviſible ſpeck in the egg to its due ſize; and for this reaſon it ſeems more eaſily convertible into nouriſhment than the yolk.

Galen therefore ſeems to have meant boiled eggs, not raw, when he commends the yolk as beſt for weak people, becauſe the white is difficult of digeſtion (δύσπεπτον γὰρ τὸ λευκὸν) (*i*) as it clearly appears from another place, where ſpeaking of poched eggs, he expreſſes himſelf in very near the ſame manner (*k*).

Broths.]

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(*h*) Harvæi Exercitat. de generatione animal. pag. 93.

(*i*) Method. Medendi, Lib. XII. cap. 6. Charter. Tom. X. pag. 285.

(*k*) Method. Medendi, ad Glauc Lib. I. cap. 10. Charter. Tom. X. pag. 355.

Broths.] Eſpecially if the animals whoſe fleſh is uſed for this purpoſe are kept faſting four and twenty hours before they are killed; for then all the crude humours are changed into their due nature by the animal ſtructure: the fleſh of animals killed is perfectly juicy, it is little more than the red blood only that is drawn off, all the other humours are left remaining, which mixing in water in boiling ſupply a matter for weak bodies, that has been already elaborated in the body of a ſound animal. But in boiling the moſt ſubtle part flies away, wich might be perſeved if the broth were made in Papin's engine, but broths ſo prepared have all a ſoapy nauſeous taſte, ariſing from the fat ſticking to the fleſh, which is ſo attenuated by the violent action of the fire and water in ſo cloſe a veſſel, as to be thoroughly incorporated with the water; beſides theſe broths are too ſtrong, and ſtand in need of dilution; ſo that in the common veſſels made deep and covered cloſe, the fleſhy ſubſtance capable of being diſſolved may all be drawn out, and nothing left behind but ſolid muſcular fibres only. Theſe broths, when cold, have the fat ſwimming upon them, which generally coagulates as it cools. This muſt carefully be taken off, leſt this oily ſubſtance, which ſoon grows rancid, ſhould offend a weak ſtomach.

But it would be a great miſtake to imagine, that the ſtronger broths are made, the fitter they muſt be for nouriſhment; for jelly-broths, as they are termed, rather load a weak ſtomach by their invincible tenacity, and conſequently ſtand in need of a moderate dilution.

And yet that by thus boiling them in common veſſels there is loſt a conſiderable quantity of the moſt ſubtle parts, appears from the grateful and reviving ſmell that iſſues from the veſſels, if they are not well cloſed while the fleſh is boiling.

Is this the reaſon why thoſe animals are fierceſt which feed on the raw fleſh of other animals? it is certain that dogs fed on raw fleſh become exceeding fierce.

The beſt fleſh for broths is commonly reckoned that of fowls, the next veal, then mutton, and laſt of all beef (*l*). Excepting the fine part, which for the moſt part flies off in the common way of boiling, the nouriſhment remaining reſides in the gelatinous part, which broths turn to when inſpiſſated. And we learn from experiments, that veal has more of this gelatinous part in it than beef, mutton a little leſs than veal, the fleſh of any young animal ſtill leſs, and the fleſh of an old cock almoſt twice as much as veal (*m*). In the Memoirs of the Royal Academy referred to, there is a table, which gives us theſe different proportions in different kinds of fleſh.

The beſt and moſt ſavoury broths are made of veal, mutton, beef, and the fleſh of common fowls mixed together; eſpecially if you afterwards ſqueeze in a little citron or orange juice, to take away their too great tendency towards putrefaction.

Panadas, or decoctions of bread well fermented.] Theſe are of great ſervice to ſuch perſons, as living in warm climates are naturally inclined to be thin and lean, and falling into acute diſeaſes are ſubject to a general putrefaction. The uſe of the fermentation is to break the too great glutinoſity of the flour, that it may not be hurtful. If theſe decoctions be made of the conſiſtence of whey, they are then moſt ſerviceable; if they are made to be as thick as cream, they are leſs eaſy of digeſtion; and if a little ſpice and wine be added to them they will be ſtill more refreſhing.

It is to be obſerved however, that theſe decoctions of bread can be carried no farther towards perfection than only to reſemble the chyle, ſo far as it is formed of the alimentary maſs, and not as perfected by an intermixture of the other humours of the body, for which

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(*l*) Herm. Boër. Mater. Med. pag. 2.

(*m*) Academ. des ſciences. Anno 1730. Mem. 314, &c.

which reaſon theſe always partake of a vegetable nature. But to form a proper human liquid of the chyle, the action of the lungs eſpecially, as well as of the other viſcera and veſſels, is required. And for this reaſon in conſumptive caſes, and all others where the lungs are took weak, we place our hopes of a recovery in the uſe of milk only; the decoctions of bread being a ſort of food more remote from the laſt and more proper matter of nouriſhment than milk.

Auſtere wines.] There is in all wines a wonderful ſtimulating faculty, and agreeable to human nature, which excites and diffuſes a grateful warmth through the whole body. If they are taken in a moderate quantity by a man not very much uſed to them, there follows a quickneſs of all the ſenſes, a very great activity in all the members, and an incredible chearfulneſs. Let the philoſopher ſpent with ſtudy take but a glaſs of wine, and he is preſently refreſhed, a calm ſerenity of mind and new vigour as it were returns upon him. The briſk ſpritely ſorts, ſuch as champaign, *&c.* have this quality, but the ſpirits ſoon flag again after them; the auſtere wines, by having their ſpirituous parts more firmly fixed as it were, apply it to the body with a more laſting effect: by their aſtringent quality at the ſame time they ſtrengthen the weak fibres more, and in this caſe are therefore to be preferred. Theſe wines are given with the beſt ſucceſs, if a little biſket ſopped in them be taken every three hours, for thus the virtue of the wine does not ſoon paſs off, but gives new life as it were to the *primæ viæ*, when flaccid. *In bread and wine there is both ſtrength and virtue* (*n*).

In a ſmall quantity.] Errors are very often committed here, by making too much haſte to repair theſe very weak bodies. The giving too much at once will oppreſs rather than relieve. What anxiety enſues, when in a phthiſis the patient takes a little too much, though it be of the beſt nouriſhment, and thereby overloads his weak lungs with new chyle! the wiſe appoint-

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(*n*) Homer. Iliad. Lib. IX. circa finem.

appointment of nature requires, that tender infants ſhould ſuck down their mother's milk often, but in ſmall quantities. If this rule be not obſerved, every thing elſe, though otherwiſe the moſt proper, will avail nothing.

2. Among the cauſes aſſigned for the too great weakneſs of the fibres, one was too weak an application of the parts to one another. This was cured by making the ſolids act more ſtrongly on their contained fluids; for every thing in the body depends on the mutual action and re-action of the ſolids on the fluids. Now this action and re-action is reſtored

By friction.] Which is in a manner the alternate preſſure and relaxation of the parts of the body. Gentle friction preſſes the veins only, whereas a ſtronger preſſes alſo the arteries. By preſſing the veins it accelerates the motion of the venal blood towards the heart; and by this means the motion of the heart is quickened, and of courſe the blood is propelled with a greater velocity through all the veſſels. The vital powers may be increaſed therefore by friction to any degree, without any foreign addition to the body. For a burning fever may be kindled by friction in the coldeſt hydropical perſon. In thoſe bodies where none of the viſcera deſtined to form the chyle diſcharge their office through a ſtate of inactivity, the rubbing the abdomen with coarſe woollen cloaths in a morning faſting has wrought wonderful effects. And for this reaſon the Antients ſet a high value upon frictions, both as a preſervative of health, and ſerviceable in the cure of many diſeaſes.

If a horſe be ſuffered to ſtand in the ſtable without dreſſing, in a few days he will become uſeleſs; but if his ſkin be curried daily with an iron comb, and rubbed with the bruſh, he will continue active for many years.

(o) *Nec minus*, ſays Columella, *quotidie corpora pecudum quam hominum defricanda ſunt: ac ſæpe plus prodeſt*

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(o) De Re Ruſtica, Lib. VI. cap. 30. pag. 597.

*preſſa manu ſubegiſſe terga, quam ſi largiſſime cibos præbeas*; "The bodies of cattle ought to be rubbed "down daily, as well as the bodies of men; and oftentimes it does them more good to have their "backs well rubbed down, than their bellies filled "with large quantities of provender."

The frictions of the Ancients were of ſeveral kinds, and deſigned often to ſerve quite oppoſite purpoſes. And thus Hippocrates has ſaid (*p*), *frictio poteſt ſolvere, ligare, carne implere, minuere, dura ligare, mollis ſolvere, multa minuere, moderata denſare*; "That friction "may looſen, or bind, may make plump, or lean; "if hard it binds, if ſoft it looſens, if violent it diminiſhes, if moderate it fills up." For if a part be rubbed with ſoft oily ſubſtances it becomes more lax.

But in curing weak fibres the beſt kind of friction is that which is made warm with rough woollen cloths, eſpecially after they have imbibed the vapour of burning amber, maſtick, *&c.* that the aromatick ſtrengthening ſteam may at the ſame time inſinuate itſelf into the laxer parts. But here we muſt proceed by degrees, and not uſe the ſtrongeſt frictions immediately; leſt the maſs which ſtagnates in the too diſtended veſſels, being preſſed towards the heart in too large a quantity, ſhould overwhelm and ſuffocate it: or leſt the yet too tender veſſels ſhould break by the too imprudent increaſe of motion.

Riding on horſeback.] The pendulous viſcera of the abdomen, nay and of the breaſt too, are by this means ſhaken every moment, and gently rubbed as it were one againſt another, while in the mean time the pure air acts on the lungs with greater force, all which conſpiring together cauſe incredible changes. But it is to be obſerved, that a weak man ſhould not ride on a full ſtomach, but either before dinner, or after the digeſtion is near finiſhed; for when the ſtomach is diſtended, weak people do not bear theſe concuſſions of the horſe without difficulty; but when the *primæ viæ* are

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(*p*) De medici officin. Charter. Tom. XII. pag. 94.

are near empty, the remaining fæces are diſcharged by this concuſſion.

Sydenham had ſo high an opinion of riding (*q*), that he believed by this alone he could cure a conſumption, provided it was not quite deſperate; or when the diarrhœa, ſo fatal in this caſe, was not yet joined to the night-ſweats; nor did he judge mercury to be more effectual in the cure of the lues venerea, or the Peruvian bark in intermittent fevers, than riding in the cure of a conſumption.

But he adviſes that the patient ſhould not fatigue himſelf with violent riding at firſt ſetting off, or all at once, but increaſe his journies and his ſpeed by degrees; and in the ſame place produces ſome extraordinary inſtances of cures wrought by this means.

He then adds, that though riding on horſeback be moſt beneficial to phthiſical people, yet that travelling in a coach has alſo wrought ſurpriſing effects.

For this reaſon, thoſe that are too weak to ſupport themſelves on horſeback, ſhould be carried in a coach 'till they have ſtrength enough to bear riding. In all ages carrying in arms and rocking in a cradle have been found of ſervice to infants, who are the weakeſt of our ſpecies.

Sailing in a ſhip is alſo of uſe to weak people. If the veſſel moves with an even motion, by increaſing perſpiration it uſually excites a wonderful alacrity, creates an appetite, and promotes digeſtion. But to be toſſed on a ſtormy ſea affects the ſtrongeſt man not uſed to it with giddineſs, vomiting, intolerable anxiety, and even fainting; inſomuch that it has happened ſometimes accidentally to have proved a cure of inveterate diſeaſes; but ſuch violent commotions raiſed in the body would by no means ſuit with weak people.

Theſe exerciſes are all of them more eſpecially ſervicable to weak people, as they hereby enjoy the benefit of motion without much fatigue. But as ſoon as the

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(*q*) In Diſſertatione Epiſtolari, pag. 523, 524.

the ſtrength begins by this means to return, the body is farther to be corroborated by muſcular motion.

And this is to be brought about by walking, running, and bodily exerciſes.] For unleſs ſuch perſons as have been thus indiſpoſed, will habituate themſelves to this kind of exerciſe, they will fall back by degrees into their former calamity: this is what we ſo frequently lament in practice. If girls that have been cured of a languid chloroſis are ſtill too fond of a ſedentary life, and do not take care to keep up their ſtrength by bodily exerciſe, they will within a few weeks become as weak and pale as before. They may expect to receive proper nouriſhment from their food though they live idle; but in ſuch a way it is impoſſible they ſhould ever breed good blood, or that the ſame ſlothful and indolent ill habit ſhould not return. *Cibi enim & labores*, ſays Hippocrates (*r*), *adverſas inter ſe poteſtates, mutuo tamen ad ſanitatem conferentes, habent, labores namque ea quæ adſunt ſolent conſumere, cibi vero & potus quæ vacuata ſunt, replere*; "For food and exerciſe have oppoſite effects, yet mutually contribute to health; exerciſe conſumes what is in the body, and meat and drink fill up the deficiency."

But how far muſcular motion may contribute to ſtrengthen a weak body, has been obſerved Numb. 2. Sect. 15.

In theſe exerciſes we muſt begin with the moſt gentle, ſuch as walking, and increaſe it by degrees 'till we come to running. Thoſe exerciſes of the body are more eſpecially ſerviceable, which give delight to the mind at the ſame time, as tennis, fencing, &c. for which reaſon the wiſdom of antiquity appointed rewards for thoſe who excelled in theſe gymnaſtick exerciſes, that by this means the bodies of their youth might be hardened for warlike toils. Cyrus made it in a manner a law to the Perſians, whoſe good education

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(*r*) Hippocrat. de vict. rationem ſanorum, Lib. I. cap. 2. Charter. Tom. VI. pag. 448.

tion was always a great part of his care, that they ſhould never eat but after labour (*s*).

3. This advice is of the greateſt moment, as diſeaſes which have been thought deſperate have often been cured by a gentle compreſſion of the veſſels only; this ſhould never be ſo great as by making the oppoſite ſides meet to deſtroy the cavity of the veſſels, for in this caſe the life of the part would be deſtroyed too, but only to draw them into a narrower compaſs than they would have had without this compreſſion. For by this means the veſſels which are too weak will be prevented from being too much diſtended by the fluids contained in them: for the capacity of a veſſel depends not upon its diſtending liquid only, but upon the exceſs of its diſtending power above the reſiſtance of the veſſel: but the more a fibre is diſtended, the more it is weakened; whatever therefore hinders the ſtretching out of the fibre, removes the cauſe which weakens it. Now bandages, or cloths drawn tight to the body, ſupply the veſſels with that ſupport, which the ſolids were too weak to do, that is, they hinder the too great dilatation.

The cure of ſome diſeaſes ſhall be more promoted by this means, than by all other means whatſoever. In an anaſarcous dropſy, where the legs and thighs are ſwollen to a great degree, if either by accident or deſign a rupture is made in the ſkin, though the water be thereby carried off, yet the parts will remain flaccid and pendulous, and unleſs you ſtrengthen them by proper bandages, they will ſoon ſwell again.

When the water collected in an aſcites is drawn off by tapping, if care be not taken to gird the belly tight with a proper roller, either a fatal ſyncope ſhall in an inſtant carry off the patient, which has frequently been the caſe, or the lax and pendulous parts ſhall fill again, and all the dreadful ſymptoms of the dropſy preſently return.

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(*s*) Mercurialis de arte Gymnaſt. pag. 9.

When the liquids ſtagnate in the dilated veſſels of the thighs, or at leaſt move more ſlowly through them than they ought, which is more eſpecially the caſe in a ſcorbutick habit, there frequently follow from a meer ſcratch of the ſkin ſuch malignant ulcers as ſhall often refuſe to yield to the propereſt applications, and yet a bandage drawn ſo tight as by compreſſing the parts to prevent the ſtagnation of the liquids, has often proved of great advantage.

I remember I once had under my care a young lady of diſtinction, who was more continually in motion than any nervous perſon I had ever attended. The leaſt noiſe in the world, or the letting in upon her too ſtrong a light, would ſtraight throw her into convulſions, the abdomen at the ſame time being drawn into a variety of ſtrange motions, and feeling as if it was rending aſunder. Neither the ferulaceous juices, nor the powerful virtue of caſtor, ſo ſerviceable in nervous complaints, were here of benefit; but when her legs, thighs, and the whole abdomen, were bound round with proper bandages, this troubleſome diſorder preſently abated, and then by the uſe of proper remedies ſhe recovered. Thus ſhe lived for ſeveral months wrapped up like an Egyptian mummy, and by no means to her diſſatisfaction, as ſhe preſently found ſo much relief from the application.

4. Hitherto we have deſcribed the cure of too great weakneſs in a ſimple ſolid fibre, ſo far as it is to be had from the uſe of the non-naturals, and ſurgery, or the application of bandages. It now remains that we point out ſuch medicines as taken internally, and left to the powers of nature, will make ſuch a change as is required to produce health. The diſeaſe was owing to the too weak coheſion of the elementary particles of the fibres. Such remedies muſt therefore be ſought for, as when applied to the body will make their coheſion firmer; and ſuch as theſe we may be ſupplied with from the materia medica.

Medicines both acid and auſtere,] which are called aſtringents. Theſe when they are applied to the tongue, do all exert their power very manifeſtly; the mouth itſelf is rendered dry by their cloſing up the orifices of the veſſels, from whence it is ſupplied with moiſture, the tongue is contracted, as it were, and made ſhorter. For which reaſon Galen has ſaid (*t*), *Guſtus ſolius proprium eſt diſcernere, quod vim aſtringendi habet*; "It is peculiar to the taſte to diſtinguiſh what has an "aſtringent power." In all theſe medicines there ſeems to be this peculiar property, that when applied to the parts of the body they draw the elementary particles of the fibres in a manner nearer to each other, and induce them to cohere more firmly: nor will this effect ceaſe to follow, though they be applied to the parts even of animals. Thus when the tanners have by long maceration ſeparated the adhering fat from the hides of animals, and ſoftened them almoſt to a degree of liquefaction, by adding to them theſe auſtere ingredients they ſhall reſtore them to their due ſtrength again; this is what Pliny terms *coria perficere*, where (*u*) ſpeaking of the pomegranate, he ſays, *Corticis major uſus ex acerbis ad perficienda coria*; "The "bark is chiefly uſed for its acerbity to give the laſt "degree of perfection to leather." At this time of day oak-bark, which is much cheaper, is made uſe of for this purpoſe. A catalogue of the principal vegetables which have this virtue are to be found in the materia medica.

Among the acid auſtere foſſils, ſteel diſſolved in a fermented vegetable acid is preferable to all others, by means whereof ſuch perſons as labour under a cold, weak, tumid habit, ſhall recover even to a miracle. It cauſes no evacuation of the diſtending liquid, but adds new ſtrength to the ſolid veſſels, where by being more contracted they drive forward the almoſt ſtagnating fluids; whereas were we to attempt to cure theſe

(*t*) Meth. Med. Lib. VIII. cap. 2. Charter. Tom. X. pag. 184.

(*u*) Lib. XIII. cap. 19.

theſe diſeaſes by evacuations, we ſhould only increaſe the weakneſs.

For the uſe of theſe preparations an agreeable warmth is found to diffuſe itſelf through every part of the body; the bloated parts ſubſide, the paleneſs of the lips and cheeks is changed into a florid ſanguine complexion; the dulneſs, indolence, and difficulty of breathing upon every the leaſt motion, ceaſe; the former activity returns, all the functions are properly diſcharged, and life is in a manner renewed.

The ſame effect is produced by the ſteel diſſolved in the medicated Spaw-waters.

Or ſuch as are ſpirituous and well fermented.] If pure alcohol be mixed with the ſerum of the blood, or the white of an egg, it preſently coagulates them. If the ſolid parts of animals be kept in alcohol, they grow much harder, and are contracted in every dimenſion. There certainly is therefore in alcohol the power of ſhortening the ſolids of animals; but then at the ſame time it coagulates the humours too. For which reaſon we ought to uſe the utmoſt caution, in giving fermented ſpirits, for they are capable of producing abundance of miſchief, both as they inſpiſſate the liquids and contract the ſolids, if uſed imprudently. In the dead body of a woman addicted to drinking, the ſpleen, pancreas, liver, and lungs, were all found dry, ſchirrhous, and in a manner partly petrified; all the glands internal and external were become very near as hard as ſtones (*w*). And many other examples of a like nature are to be found in the obſervations of other authors.

Prudently and gently, *&c.*] For all theſe, when given internally, act firſt upon the ſtomach and inteſtines, and can never enter the blood with their powers entire, for then they would do miſchief; they ought to be given therefore in ſmall quantities, often repeated, that ſo they may gradually enter into the blood after being firſt diluted by the humours. If a few grains only of

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(*w*) Academ. des ſciences, l'ann. 1706. Hiſt. pag. 29.

of the moſt acerb juice of the Egyptian acacia be held in the mouth, it cauſes a general contraction, and ſo ties up the orifices of all the veſſels on the inſide of the mouth, that in half a quarter of an hour it becomes perfectly dry; ſhould this therefore be applied to the moſt tender orifices of the lacteals, it would intercept its own paſſage by cloſing them. But as theſe all act, firſt on the *primæ viæ*, and cannot enter the mouths of the lacteals 'till they are greatly diluted, and ſo inſinuate themſelves by ſtealth, as it were, into the blood: for this reaſon they cannot arrive at the laſt ſtage of the circulation but with their powers very much diminiſhed. To this purpoſe Galen has well obſerved (*x*), *Quocirca medicamenti, ſive id foras applicatum, ſive ex illis fuerit, quæ devorantur vel potantur, poteſtatem præſentem non oportet conſiderare, ſed qualem habebit, ubi ad affectum locum pervenerit*; "That it is not ſufficient to conſider the preſent power of a medicine, whether externally or internally given, either by a liquid or ſolid form, but what its power will be when it comes to the part affected."

Theſe acid auſtere medicines, however, eſpecially thoſe of the ſtronger ſort, if they are given imprudently, may produce very ſad diſeaſes, partly by coagulating the liquids, and partly by cloſing up the mouths of the very ſmall veſſels, which are ſpread over the internal ſurface of the ſtomach and inteſtines.

For which reaſon ſteel diſſolved in the milder acids is commonly preferred to all others, becauſe it acts not only by its auſtere aſtringent virtue, but becauſe by the wonderful ſtimulus of its metallick ſulphur, which is ſo friendly to our nature, it raiſes the vital powers.

5. Diſtention has a tendency to withdraw the elementary particles of the fibres from their mutual contact; and of courſe to diſpoſe them not to cohere at all, *i. e.* to break. That condition which approaches neareſt

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(*x*) De Meth. Med. ad Glauc. Lib. II. cap. 4. Charter. Tom. X. pag. 375.

neareſt to a rupture is the weakeſt degree of coheſion, or the coheſion which is capable of being deſtroyed by the leaſt additional force; whatever therefore draws the elementary particles aſunder, makes the fibre weak by leſſening its coheſion. When the ſtring of a muſical inſtrument is ſtrained by a weight hung to it, it is made longer, increaſe the weight and it grows longer ſtill, 'till at laſt it breaks. The moment, however, before it broke it ſtill cohered, though ſo little, that with the addition of a very little more weight it was liable to be broken: now the way to increaſe the ſtrength of the chord, whilſt in this ſtate, was to take away the weight that ſtrained it.

The caſe is the ſame with regard to our fibres: for as the diſtending cauſes leſſen, the ſtrength of the fibres increaſes almoſt every moment, from the natural tendency they have to contract themſelves. Of this we have many very plain inſtances in diſeaſed perſons. In a caſe where the œſophagus was ſo oppreſſed by a ſchirrhous humour gradually increaſing, that in the laſt months of a miſerable life, the patient could ſwallow nothing but a few drops of milk diluted with water, or thin broth, and that not without the greateſt difficulty. When the body came to be opened, I obſerved the capacity of the ſtomach did not exceed the ſize of one of the ſmall guts: for as the ſtomach had not been diſtended at all for ſo many weeks, its fibres had contracted themſelves into this narrow compaſs.

This wonderful property obtains in all the ſolid parts of our body, that if they continue long in the ſame contact, they ſhall ſo cohere as not to be ſeparated after.

If a man be confined to his bed for a broken leg and the Surgeon does not take frequent care to bend his joints gently, upon his recovery thoſe articulations ſhall be all immoveable: for the ligaments not having been diſtended for many weeks together will become hard and ſtiff.

SECT

## S E C T. XXIX.

A Fibre is ſaid to be *lax*, when its parts do ſo cohere (21) together, as by the application of a very ſmall fibre it may become longer than it was before; it is plain therefore that this is a kind of weakneſs (24), and that *flexility* depends upon it; that theſe therefore and alſo the *leſſened elaſticity* of a fibre may clearly be underſtood from what has been ſaid (21, 22, 23, 24, 25, 26, 27, 28.) For even glaſs, which is a very brittle body, when drawn by art into threads, which are finer than thoſe of a ſpider's web, does ſtill cohere, and may be bent every way with very little force into a great variety of foldings without breaking; its flexibility increaſing in proportion to its fineneſs. *Ac. reg. ſci.* 1713. *hiſt.* 11.

*Laxity.*] The fibres were ſaid to be too weak, when they were unable to ſuſtain that force, which neceſſarily aroſe from the diſcharge of the functions in a ſtate of health, without loſing their coheſion; or though they could ſuſtain the powers of perfect health, were yet liable to be broken by the leaſt increaſe of motion, which in the courſe of human life was unavoidable. Now by too great a laxity of the fibres is to be underſtood that ſtate, wherein though they cannot bear the force of vital motion without loſing their coheſion, yet if they be ſtretched or pulled out by any ſmall force, they ſhall by this means become longer than they were before.

A thread of ſilk that is unable to ſuſtain a weight that is hung to it without breaking, gives us an idea of a fibre too weak; a line made of very ſoft lead, drawn out into a very great length by the application of a like weight without breaking eaſily, gives us a true image of a fibre that is too lax.

On the due laxity of the fibre however depends their

*Flexility.*] For that every office ſhould be diſcharged in the body, which is daily obſerved to be wrought by the motion of the humours, veſſels, and muſcles, the elementary fibres of the ſolid parts muſt in ſome meaſure depart from their contact, and in ſome meaſure perſiſt in it, in order hereby to admit of elongation. For inſtance, there could be no bending of the joints, unleſs the ligaments by which they are tied, were capable of being lengthened. For which reaſon there is a certain degree of laxity requiſite to health, which when it is increaſed becomes a diſeaſe.

*Leſſened elaſticity.*] The elaſticity of the fibres conſiſts in this, that they are capable of being extended, and when the extending power is removed return to their former length.

But this power conſiſts only in the effort wherewith the ſmalleſt conſtituent particles of a fibre attract each other, when made more diſtant by the lengthening of the ſuperficies, without a rupture of their coheſion. If therefore by any cauſe a fibre is made ſo weak that its parts attract each other with too little force, its elaſticity is of courſe diminiſhed.

Our greater veſſels are compoſed of ſmaller ones, and theſe of much ſmaller ſtill, nor has anatomy hitherto diſcovered where they terminate. The muſcles conſiſt of ſmaller muſcles, and that which to the naked eye appears a muſcular fibre, when examined by a microſcope ſhews itſelf to be a bundle of leſſer fibres.

The ſame is obſerved of the nerves, *&c.* ſo that all the parts of the body ſeem to conſiſt of infinitely ſmall ſimilar parts: this was indeed no more than requiſite to produce their flexility; for in the inſtance produced above it appears that glaſs, the moſt brittle of all bodies, may be made ſo ductile by merely dividing it into very fine threads, that the ingenious Monſieur Reaumeur did not doubt but that it might one day fall under the workmanſhip of a weaver (*a*). I have myſelf ſeen falſe hair made of glaſs drawn into threads, that would admit of being curled without breaking.

## S E C T. XXX.

THE ſame principles alſo furniſh us with an eaſy anſwer to the following queſtions: why watery and fat aliments cauſe a weakneſs in the fibres? why the fibres are weak in perſons that are of a cold conſtitution, that are youthful, uſe no exerciſe, and are ſtill growing? why earthy and auſtere ſubſtances give ſtrength to the fibres? why the fibres are ſtrong in perſons who are of a hot conſtitution and given to much exerciſe? why proportioned elaſticity of the fibres is joined with their ſtrength?

Why watery and fat aliments, *&c.*] This we learn from experiment. For the hardeſt parts of animals, if ſoaked in warm water, eſpecially if expoſed to the vapour of it, will become very ſoft. Old ſtags horns, from hanging in the vapour of warm or boiling water, will grow ſoft enough to be cut with a knife, as we ſee in that medicine which is called the philoſophical preparation of hartſhorn.

To how weak and flaccid a ſtate do thoſe young women reduce themſelves, who are accuſtomed to a daily habit of drinking warm aqueous liquids? In that book of the uſe of liquids which are aſcribed to Hippocrates, the following miſchiefs are aſſigned as the conſe-

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(*a*) Acad. des ſciences, l'ann. 1713. Mem. pag. 279.

conſequences of drinking warm water too freely (*a*), *Carnium effæminationem, nervorum impotentiam, mentis ſtuporem, hæmorrhagias, animi deliquia* ; "Tenderneſs "of the fleſh, weakneſs of nerves, ſtupor of the mind, "hæmorrhages, and faintings."

The weakneſs of a fibre conſiſts in ſuch a coheſion of its parts, as may eaſily be ſeparated ; but the elementary parts of water cohere very ſlightly ; for which reaſon poſſibly if two or three of the particles of water be interpoſed between the elementary parts of the fibres, the fibre ſeems to be made weaker thereby ; whereas if a ſingle particle only were between them, it would be much the ſtronger for it : for the elementary particles of water conſidered in themſelves ſeem to be perfectly hard and immutable, and capable of coaleſcing with other bodies in a wonderful manner, as has been ſhewn in the explication of §. 21. And hence perhaps the reaſon may be deduced why the parts of animals when ſoaked in water ſhall become the ſofter : but when dried again ſhall be much ſtiffer than before. For we learn from experiments, that water is capable of inſinuating itſelf between the elementary particles of bodies and removing them from their contact. Shreds of paper ſteeped in water become longer by almoſt a ſixth part (*b*).

That oily ſubſtance will for the ſame reaſon ſoften the ſolid parts, appears from abundance of experiments. The ſtiffeſt hides of animals, when ſoaked in oil, will become ſoft ; the muſcles, in order to retain their due flexility, are covered over with oily caſes ; ligaments are lubricated with the medullary oil attenuated, that they may not grow ſtiff. And when this oil begins to fail, as in very old age, how very hard do they become ! In fat bodies, where this oil too much abounds, how greatly relaxed and tumid is the whole weakly compoſition ?

Why

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(*a*) Cap. 2. Charter. Tom. VI. pag. 444. & Aph. 16. Sect. 5. Charter. Tom. XI. pag. 203.

(*b*) Academ. des ſciences, l'ann. 1714. Mem. pag. 72.

Why in perſons that are cold.] We here mean perſons that are of a cold conſtitution. For cold, abſolutely conſidered, induces ſtrength by drawing the elementary particles nearer to each other; but in perſons of a cold conſtitution, the circulation is weaker, the blood is leſs compreſſed, the crude aliment is not much changed, and the minute elementary particles are applied to each other with leſs force, and from hence follows a leſſer coheſion.

That are youthful.] The human embryo, in its firſt formation, is no more than an exceeding ſmall ſpeck. Afterwards, when it is grown larger, ſo as to come within the notice of the ſenſes, it would fall together like a mucus, if it were not ſuſtained by the equable preſſure of the ſurrounding liquid. The infant, when it is juſt born, is quite ſoft and pulpy, with bones that are ſtill flexible; as it grows older it grows firmer by degrees. The nearer therefore a man is to his original, the ſofter are all his parts. For which reaſon, though his fibres have a firmneſs ſuitable to his age, yet they may be called weak, if compared with the fibres of an adult. But this was requiſite that the human body might admit of being extended in every dimenſion during its growth from ſo very ſmall to ſo large a bulk.

Who uſe no exerciſe.] See §. 25. numb. 2. When girls are cured of their languid diſeaſes by the ſalutary uſe of ſteel, and neglect to uſe exerciſe, how ſoon do they relapſe into their former weakneſs! Hippocrates enjoined labour to ſuch perſons as languiſhed under a dropſy; but to ſuch as were afflicted with acute diſeaſes he ordered abſolute reſt: for in the latter caſe, the active powers of life being raiſed too high by the fever, tended to conſume all the liquids, and make the ſolids perfectly dry. For which reaſon, the whole cure almoſt of acute diſeaſes conſiſts in bringing on a diſpoſition towards a dropſy; that is, reducing the patient to a greater degree of weakneſs.

Who are growing.] The humours being impelled through full conical veſſels from the *baſis* towards the *apex*, do conſtantly endeavour to lengthen the ſides of their canals in the direction of their longitudinal axis. As long therefore as the canals give way and admit of being lengthened by this force, a man grows. For which reaſon a leſs firm coheſion was requiſite that they might give way. But we ſee the quickeſt growth approaches neareſt to the firſt formation of the man, in which periods the ſolids are ſcarce capable of making any reſiſtance; for in the ſpace of nine months, he grows from an imperceptible ſtamen to a bulk that ſhall weigh ſixteen, ſometimes twenty, pounds.

We farther ſee ſometimes, that a fever happening to a young perſon before he has attained his full growth, ſhall ſtretch out the veſſels which are yet capable of beng eaſily lengthened, and make a very ſenſible addition to his ſtature A leſs firm coheſion of fibres therefore was required to his increaſe, that they might give way. When therefore the bodies of young people are too much hardened by violent labour, their growth is ſtopped before its time. And for this cauſe it probably is, that ſuch perſons as breed up lap-dogs for the ladies, who generally like the ſmalleſt beſt, give them brandy or wine every day while they are young, to ſtop their growth.

Why earthy and auſtere ſubſtances.] Of auſtere ſubſtances we have ſpoken already, §. 24. numb. 4. Theſe bodies ſeem from experiments to be endued with a certain power of drawing the elementary particles of our fibres nearer to each other. But the nature of earthy bibulous bodies is, to attract all the liquids that they can touch, and then to form with them the ſtrongeſt concretions. A tobacco-pipe juſt baked and not glazed, as ſoon as it touches the lips, will ſtick ſo very faſt that it can ſcarce be taken away without hurting them. Since therefore watery ſubſtances debilitate the fibres, as appears from what was ſaid before, thoſe ſubſtances which abſorb water, are to be reckoned among the ſtrengtheners.

Why to perſons that are hot.] External heat applied to the body univerſally weakens it: for it ſets the elementary particles of the fibres at a greater diſtance, and ſo makes the fibres weaker. But here we more particularly mean perſons of a hot conſtitution, in whom the denſe and compacted humours are impelled through the veſſels with a very violent motion; in theſe perſons the aſſimilating faculties are always ſtrong, and the application of the elementary particles of the fibres to each other very powerful. On which circumſtances the ſtrength of the fibres depends.

Daily experience teaches us the difference there is between heat got by exerciſe, and that of the fire-ſide. He that guards againſt the winter's cold by ſitting near the fire, riſes from it dull and heavy; whilſt he that gets the better of it by ſtrong bodily motion, is always lightſome and active.

And given to much exerciſe.] Of this we have treated §. 25. numb. 2. The countryman who provides bread for himſelf and family by hard labour, is firm and robuſt in every part, he deſpiſes all the inclemencies of weather, feeds on the hardeſt fare, and digeſts it perfectly well: while the man who gives himſelf up to luxury and idleneſs, ſpends his days in weakneſs and miſery. He is ſenſible of every the leaſt change of weather, and is ſcarce able to ſwallow down a morſel, though provoked to it by numberleſs appliances, which, fulneſs and not hunger, has invented, to create an appetite.

Why elaſticity, &c.] Thoſe bodies are termed elaſtick, which upon being diſtended return again into the ſame points of contact they were in before; there is a ſtrong power requiſite therefore by which the parts that are thus diſtended muſt attract each other; and in this power conſiſts the ſtrength of the fibres.

The following example may illuſtrate this matter. If two magnets touch one another they will cohere: if they are removed from each other to a ſmall diſtance, yet not ſo far but that they can ſtill act one upon another, they will come together again: ſo likewiſe the parts of an elaſtick body when ſtretched out will attract one another again, as ſoon as the diſtending force is removed, and continue to cohere as before. Preſs the fleſh of a weakly leucophlegmatick wench with your finger, and it will pit like dough, and riſe again but very ſlowly, if at all; do the ſame thing to a ſtrong man, and the part will ſoon be reſtored to its former ſtate by its elaſticity.

Thus have we given a deſcription of the moſt ſimple diſeaſe, and laid down a rule, how to find out the nature of it; we have then proceeded to point out the particular cauſes to which it is owing, and have likewiſe ſhewn the præternatural effects, which are apt to follow upon it; and how from theſe we may form a prognoſtick of the future events; as alſo by what means, from the diagnoſtick ſigns of the diſeaſe, an indication may be obtained, ſufficient to direct the Phyſician in what manner, and by what inſtruments, he may effect a cure; and after this have drawn ſome general corollaries from the whole.

It ſeldom happens, indeed, that the caſe of weakneſs in a ſimple ſolid fibre comes alone, without being attended with many other diſorders. It was requiſite however to conſider it thus abſtractedly, in order to give a clear notion of it; and for this reaſon we introduced a man in perfect health, whoſe fibres we ſuppoſed of a ſudden grown too weak from any intervening cauſe whatſoever.

# The DISEASES of a ſtiff and elaſtick FIBRE.

## SECT. XXXI.

THE too great ſtiffneſs of a fibre is the joining together of its ſmalleſt particles in ſuch manner (21), as ſhall cauſe them to cohere ſo cloſely, that they ſhall not yield to that action of the fluids, which ought to overcome this reſiſtance, in order to preſerve health.

Our life and health depend entirely on this, that all the fibres in every artery ſhould be ſo plyable as to admit of being diſtended by the blood, that is, expelled by the muſcular power of the heart to ſuch a degree, as to be able to receive the blood that is thus expelled. For while the heart is in its diaſtole, the arteries and veins are full, elſe there would be no continued propulſion of the blood. The next moment in its ſyſtole the heart throws out the blood into the full arteries, and through thoſe into the veins which are alſo full: if theſe veſſels therefore ſhould reſiſt being dilated with an infinite force, and the blood were not compreſſible as it is, the heat could not be evacuated, as life would ceaſe. Such a laxity therefore is required in the fibres which conſtitute theſe veſſels, as that they may yield to the diſtending blood expelled from the heart into theſe full veſſels. Now the more rigid theſe fibres are, the greater is their reſiſtance.

For this reaſon, as we obſerved alſo of a weak fibre, no abſolute definition can be given of a too rigid fibre, but ſuch only as is relative to the different age of the ſubject, *&c.* thus that the little heart of a ſmall embryo may ſuffice to dilate the veſſels by the blood propelled from it, no greater coheſion is required, than that all the ſolids ſhould reſemble a mucus.

## SECT. XXXII.

THIS (31) will follow from all thoſe cauſes which are neceſſary to the cure of a weak fibre (28) if perſiſted in too loog, and too frequently applied.

We have premiſed the account of a too weak fibre, as the cure of this diſeaſe lets us into the knowledge of the cauſes why a fibre is too rigid. Whatever therefore relates to the cure of a fibre that is too weak might be here repeated, but one example ſhall ſuffice.

Moderate labour ſtrengthens the body; exceſſive labour dries it, and makes every part of it too ſtiff. Country-fellows, who are obliged from their childhood to violent exerciſe and exceſſive labour, often die at forty, of a like maraſmus with that which is incident to old men, having their juices all exhauſted, and their ſolids too rigid, and becoming decrepid before their time.

## SECT. XXXIII.

THIS diſeaſe (31), wherever it is preſent, cauſes the veſſels, which conſiſt of theſe fibres, to be leſs flexible, narrower, and ſhorter, and liable to reſiſt too much the motion of the liquids paſſing through them, with all the conſequences following hereon; ſee (50, 51, 52, 53.)

Our veſſels always reſiſt diſtention; for which reaſon their capacity depends on the exceſs of the diſtending powers above this diſpoſition to contract. When therefore the contractile power of the veſſels is increaſed, and the diſtending power remains the ſame, the veſſels will be the more contracted, that is, they will become narrower. The laſt degree of this diſeaſe is, when the veſſels will not yield in the leaſt to the diſtending liquids; hereby the motion of the blood is preſently ſtopped, and that moſt gentle old-man's death enſues, when every fibre, being grown ſtiff through extremity of age, does not give way to the impelled fluids. If the liquids be diminiſhed by any cauſe whatſoever, the ſtrength of the veſſels reduces them to ſo narrow a compaſs, that though they ſtill continue full, they are notwithſtanding much leſs diſtended.

A man may loſe half his weight by an acute continual fever in fourteen days, his veſſels contracting as the quantity of liquids diminiſhes. This clearly appears, as all animals have their veſſels ſo much the more contracted, as the ſtrength of their fibres is increaſed.

If an horſe ſtanding in the ſtable be plentifully fed, and thereupon growing fat, be taken thence, and gradually rode hard, ſo as to loſe, perhaps, a third part of his weight, he ſhall, notwithſtanding, be more ſtrong to labour, and the fibres of his veſſels being hereby conſolidated, though he afterwards ſtand idle in the ſtable again, yet he ſhall not become fat again ſo ſoon.

Shorter.] The force of a liquid impelled through flexible conical canals tends to lengthen thoſe canals; and by this means they are lengthened as far as the coheſion of the fibres will admit, as we learn from the remarkable growth of young people after an acute diſeaſe. I remember to have ſeen, upon the cutting off of a great toe, at one ſtroke, with a ſharp inſtrument, that two of the arteries were extended beyond the level ſurface of the wounded part to the length almoſt of a geometrical line: to ſuch a degree were theſe veſſels lengthened in a ſituation ſo remote from the heart. But when the fibres are grown too ſtiff, they will not admit of being thus lengthened; on the contrary, as the ſtrength of the fibres prevails, they ſhall become ſhorter. This we ſee in old men, who in reality grow ſhorter than they once were.

The motion of the liquids, *&c.*] When the heart propels the blood through the arteries, part of the force communicated from the heart is ſpent in dilating the arteries, whilſt the remaining part propels the blood through the arteries. If therefore the arteries become leſs dilatable, *i. e.* more rigid, more of the motion communicated by the heart muſt be ſpent in dilating them, and leſs in propelling the blood. And from hence the reaſon is plain, why fibres too rigid increaſe the reſiſtance given to the motion of the liquids.

But every office in the human body depends on the due motion of the humours through the veſſels; ſo that infinite miſchiefs may ariſe from this ſimple cauſe, of which more hereafter in the numbers cited.

## SECT. XXXIV.

FROM which (31, 32, 33) this diſeaſe (31) is capable of being known, its future effects likewiſe of being foreſeen (33), nor is the method of cure, which it requires, leſs evident.

From the three preceding ſections we may eaſily collect the diagnoſtick ſigns of a too great ſtiffneſs in the fibres. If, for inſtance, we ſee a perſon lean, with the inſide of his mouth and jaws drier than ordinary, little or no moiſture upon the ſkin, and a more than uſual ſtiffneſs in his joints, and this notwithſtanding he takes down a ſufficient quantity of nouriſhment, we conclude that the ſolids are too firm and powerful for the liquids, and paſs them off too haſtily. Theſe men are at the ſame time lean and voracious; as they very ſoon digeſt whatever they take down and throw it preſently off.

Now if we know that ſuch food and medicines have been adminiſtred as were enumerated in the cure of too weak a fibre, we foreſee that this diſeaſe of too great ſtiffneſs is likely to follow.

And according as this too great ſtiffneſs happens in a ſingle part, or in the whole body, very different and ſurpriſing diſeaſes will enſue; for we learn from experience, that all the known canals of our body are capable of growing ſtiff, and oftentimes from ſuch minute cauſes, as can by no means be diſcovered.

Thus ſometimes a finger, ſometimes the whole arm, ſhall by degrees decay and become dry: for if the reſiſtance of the veſſels be increaſed from any cauſe whatſoever, the extenſion of them will be leſs, and of courſe a very ſlow maraſmus enſue. I have ſeen a woman not forty years old, whoſe body in two years time has been ſo waſted with a lingering maraſmus, as to leave nothing behind but a ſqualid ſkin to cover her bones, and this without any viſible defect in the frame of the body, or any ſuſpicion of an internal ſuppuration, or the increaſe of any ſenſible evacuation. Poſſibly they were ſuch diſtempers as theſe, which the antient Phyſicians called ἐκ νόσȣ γῆρας, (*a*) *old age ariſing from diſeaſe.*

Santorini (*b*) tells us in his very accurate anatomical obſervations, that as he was examining the body of a man, whoſe right eye had been long ſubject to a true amauroſis, he found the optick nerve of that ſide ſmaller than in a natural ſtate, and of a darker colour. In this caſe poſſibly there may have been too great a rigidity in the right optick nerve from ſome ſecret cauſe. And if the like circumſtance happens in the other organs of ſenſe, or in the viſcera, different diſeaſes may follow without number.

From

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(*a*) Galen. Method. Med. Lib. VII. cap. 6. Charter. Tom. X. pag. 167. (*b*) Cap. 3. §. 14. pag. 64.

From theſe obſervations duly conſidered the proper means of removing the too great rigidity of the fibres are eaſy to be diſcovered, and are enumerated in the following ſection.

## SECT. XXXV.

FOR this is obtained 1. By a thin watery diet, eſpecially whey, very ſoft herbs, mealy ſubſtances diluted and unfermented. 2. By indulging reſt in a moiſt cool air, and long ſleep. 3. By aqueous medicines both externally applied and inwardly given in a lukewarm ſtate, by the adminiſtration alſo of ſuch as are inſipid, and are of a moſt ſmooth, ſoft, and oily, nature.

1. By a thin watery diet.] We call that drink watery, which conſiſts either of pure water itſelf, or in which water predominates. We call that food watery, which is principally made up of water, ſuch as gruels, broths, and the like. If theſe be internally given, they ſupply the parts within with a conſiderable quantity of water, convey it through all the veſſels, and thereby ſoften and lubricate every part; for the property peculiarly belonging to water, eſpecially if warm, is to ſoften the hardeſt parts of an animal body: for we can make their horns, nails, nay even their very bones, ſoft with warm water.

For this reaſon we ſee, that in all thoſe nations, which live in the hotteſt climates, and have the leaneſt bodies, their appetite leads them ſcarce to any thing elſe but water and watery food. Nor ſhould it ſeem ſtrange, that whey is here recommended, becauſe milk has before been ſaid to be very ſerviceable towards ſtrengthening the fibres when too weak: for in whey there is none of the ſubtle ſpirituous ſubſtance, none of the ſubſtance which coagulates into cheeſe, nor any thing indeed left remaining but the watery part enriched with the diſſolving virtue of the graſs. Butter-milk more eſpecially deſerves to be commended in this caſe, as it has none of the fatneſs whereof the butter conſiſts, and is ſomewhat acidulated, and conſequently of ſo great a ſervice in acute diſeaſes. Under this head we may likewiſe bring all the juices of the ſummer-fruits, when thoroughly ripened.

Very ſoft herbs.] Theſe are all enumerated in the *materia medica* of the celebrated author. They have none of them either any conſiderable ſmell or taſte, but rather conſiſt of a watery and moſt emollient mucilage. And for this reaſon broths made of theſe are ſo very ſalutary in atribilarious caſes.

Mealy ſubſtances diluted.] In very dry bodies, where the humours are always denſe and compact, the water that is drank ſoon paſſes off, and makes but a ſhort ſtay in the body. This is frequently the unhappy caſe in acute diſeaſes, wherein the water taken down preſently runs off by ſweat or urine. To the water therefore muſt be added the mealy ſubſtances deſcribed in the *materia medica* with this intention, that the water by means of this mealy lentor may adhere the more as it were, and not be ſo ſoon driven out of the body. This ſeems to have been the reaſon why Hippocrates condemns the uſe of water in acute diſeaſes (*a*), though in the ſame book he commends highly the uſe of a ptiſan. Theſe mealy ſubſtances give a lentor to the water, and by the oil, that lies wrapt up in them, which will mix with water, and may be expreſſed pure out of them, prove univerſal emollients. It is certain, that water-gruel only, drank daily in a large quantity, will ſo far enfeeble the ſtrongeſt man, as to bring upon him a general languor. This the country people are ſo well acquainted with, that they will fat their hogs with meal alone mingled with water or ſkimmed milk.

In this country many of the common people who ſit to work, which is not very laborious, and at the ſame

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(*a*) De victu Acutor. Morbor. Charter. Tom. XI. pag. 102.

ſame time live almoſt wholly upon mealy ſubſtances, have their bodies conſtantly in a lax ſtate.

And unfermented.] The ſame obſervation will hold good of the juices of the ſummer-fruits; for fermented ſpirituous liquors were juſtly reckoned among the remedies of a weak fibre. For from all theſe are ſpirituous liquors capable of being produced by fermentation, which when raiſed to the higheſt degree will burn up all the ſolids of the body almoſt like fire, and condenſe the blood into grumous clods, which cannot again be diſſolved.

2. By reſt, *&c.*] Muſcular motion was reckoned the principal remedy in curing a fibre when too weak; no wonder therefore if reſt produces the ſame effect. They who would moſt ſpeedily fatten animals keep them conſtantly free from motion, and at the ſame time feed them to the full. For which reaſon, in acute diſeaſes, where all is dried up, the antient Phyſicians injoined abſolute reſt, and eſpecially in an air diſpoſed to be cool and moiſt: for a cold and dry air ſtrengthens the fibres.

But nothing relaxes the body more than the warmth of a bed or longer ſleep than ordinary; for in this caſe the patient lies in a bath of vapours exhaled from his own body. For which reaſon all animals are turgid after ſleep. And Hippocrates therefore ſaid (*b*), *Longiores verò ſomni calefacientes colliquant carnem, & corpus diffundendo reſolvunt, & imbecillum reddunt*; "That long ſleep by its warmth diſſolves the fleſh, "and by its diffuſing quality reſolves and weakens "the whole body."

And in another place (*c*); *In quibuſcunque morbis ſiccitas confert, conducit quàm minimum dormire. Quibus verò humiditas confert, non debent enidiam pati, nec cibo aut potu indigere, neque laborare, & dormire quantum volent*;

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(*b*) De victu ratione Sanorum, Lib. II. cap. 10. Charter. Tom. VI. pag. 474.

(*c*) De affectionibus, cap. 12. Charter. Tom. VII. pag. 632.

*volent*; "In all diſeaſes where dryneſs is of ſervice, it "is adviſeable to ſleep very little. But where moiſture "is required, the patient ſhould not be expoſed to "hunger, want meat or drink, or uſe exerciſe, but "ſleep as much as he pleaſes."

3. The principal of theſe, and the baſis of all the reſt, is water, which when warmed and turned into vapour, will ſo ſoften even the hardeſt parts of animals, as almoſt to throw them into a liquid ſtate. In acute diſeaſes, wherein the ſkin is frequently ſo very dry, as to carry nothing off by tranſpiration, the orifices of the veſſels, through which we perſpire, being quite cloſed up, it is to no purpoſe to endeavour to provoke a ſweat by warm medicines: but if the body be expoſed naked to the vapour of warm water, the mouths of the veſſels will uncloſe, the ſkin grow moiſt, and a profuſe ſweat ſoon after enſue. But as in theſe diſeaſes the internal parts are altogether as dry as the outward ſkin, it is uſual to inject reſembling clyſters, and give thin decoctions of mealy ſubſtances in water, in order to ſoften all within; inſomuch that when the body has been more weakened than it ought by theſe watery applications, an oppoſite evil, *i. e.* a dropſy, has thereby been produced.

Theſe watery applications ought all to be made warm: for cold condenſes and ſtrengthens the fibres; and yet if given too hot they will coagulate the blood and burn up the ſolids into a gangrenous cruſt.

They ought all likewiſe to be given unſalted, for ſalts harden, as we ſee in ſalt fleſh. At the ſame time we find very great relief from

Mild oily medicines.] It is well known that the hides of animals when ſteeped in water will grow flabby, but when dried ſhall become more ſtiff than they were before; theſe alſo if rubbed well with oil ſhall remain ſoft a conſiderable time; for oil ſticks cloſer, and is not carried off ſo ſoon. When the fibres of the inteſtines are contracted by ſpaſms, which cauſe ſuch terrible excruciating pains, large draughts and clyſters of very ſmooth oil, to the quantity of ſome pints, ſhall relax the fibres and remove the ſpaſm.

In acute diſeaſes, where a very great dryneſs and ſtrength of the ſolids ariſe from the diſeaſe, or oftentimes pre-exiſts before it, theſe applications would be of excellent uſe, if the increaſe of heat did not corrupt the oils, which eaſily grow rancid, and turn their mildneſs into ſharpneſs: in this caſe the decoctions of the mealy kind, enumerated in the *materia medica*, do well ſupply their place; for from all theſe, eſpecially when dried, may be expreſſed a pure oil in a large quantity, which is not diſcernible in theſe decoctions, being ſo united to their mucilage, as to preſerve the entire emollient virtue of the oil, without any danger of growing rancid.

When this diſeaſe of too great rigidity is fixed in ſome particular joint (for an anchyloſis often happens by the ligaments being ſo hard as not to ſuffer the extenſion required to bend the joint) the moſt ſucceſsful way of treating it is by rubbing well the part affected with a lixivium of ſoap, ſo as to make it perfectly clean and perſpirable, and then ſeveral times a day expoſing it to the vapour of warm water: at the ſame time the dried part muſt be anointed with very ſmooth oil; and the too rigid ligaments gently ſtrained by bending the joint. For too violent a ſtraining was aſſigned as one of the cauſes why a fibre may become too weak, and therefore after the forementioned applications it cannot but be highly ſerviceable to diſtend the too rigid parts.

The Antients, in order to reſtore an emaciated part to its former ſtate, would irritate the parts affected 'till they brought on a ſlight inflammation and ſwelling; for by this means the humours being carried to the part with greater force and celerity, dilated the veſſels that were before too narrow. And thus, by frequent repetition, the reſiſtance of the coats of the veſſels was ſo far diminiſhed, as to yield to the humours which naturally flowed into them, and the part rendered fleſhy as before. Thus Galen, in a few days, cured many of his patients by rubbing the muſcular parts with oily ſubſtances, who had long been conſumptive and in a waſting condition (*d*).

Friction therefore is good in this caſe, but with ſome oily ſubſtance, and only ſo as to bring a light redneſs upon the part: for if you go farther, you diſcuſs that which friction had invited into the part, a greater diſtenſion of the veſſels, which were too ſtiff before, being all that is required here. This Galen carefully adviſes in the following words (*e*), *Ideoque ubi carne implere quodlibet corpus volumus, id eo uſque calefaciendum eſt nobis, dum intumeſcat; ube vero diſcutere & vacuare cupimus, continuandum eſt eo uſuque, dum, quod intumuit, ſubſidat*; When we would make any " part fleſhy, we muſt rub it 'till we make it ſwell; " but when we would diſcuſs or leſſen the bulk of it, " we muſt ſtill rub on, 'till the part which has ſwel- " led ſhall ſubſide."

And in another place (*f*), *Ferulas parvas ac leves modice illitas grucilibus partibus incutiunt, donec modicè attollantur*; It is uſual to ſtrike gently upon parts that " are too lean with ſmall rods ſlightly greaſed, 'till " they begin to be plumped up." By thus ſtriking upon the buttocks of a boy every day or every other day, he tells us, that in a ſhort time, from being very lean they became very fleſhy.

Hence it appears, that friction may ſometimes produce quite oppoſite effects, *i. e.* if it be hard with rough dry woollen clothes, eſpecially ſuch as have imbibed the fumes of burning aromaticks, it will be of ſervice in the cure of weak fibres; whereas it will ſoften the fibres when too rigid, if it be gentle and uſed

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(*d*) De Sanitate tuenda, Lib. V. cap. 3. Charter. Tom. VI. pag. 143.

(*e*) Meth. Med. Lib. VII. cap. 6 Charter. Tom. X. pag. 172, *&c.*

(*f*) Meth. Med. Lib. XIV. cap. 19. Charter. Tom. X. pag. 336.

uſed with oily ſubſtances, as it will by this means attract the humours and relax the ſolids.

## SECT. XXXVI.

FROM hence the too great elaſticity of a fibre is underſtood, as alſo the method of curing it, being generally the attendant upon and effect of (31) ſtiffneſs.

It has been already explained what ſtiffneſs is, which always increaſes in the ſame proportion with elaſticity; for a body perfectly hard, which no force can bend, is ſcarcely to be found. For which reaſon, as elaſticity (as was ſaid §. 29.) depends upon that power, by which the conſtituent parts of a fibre endeavour to cohere, and this power is proportionably greater in a fibre that is too ſtiff; it plainly appears, that too great an elaſticity muſt always accompany too great a ſtiffneſs.

Balls made of ſoft clay, if they ſtrike againſt one another in oppoſite directions, will ſtand ſtill; but after they are baked in an oven they will become elaſtick, and fly back upon the congreſs.

## SECT. XXXVII.

WHY laxity prevails in children, women, and idle perſons? on the contrary, in adults, in men, in thoſe who exerciſe, the fibres are hard and ſtiff, and conſequently all the ſolid parts? as alſo why there is a ſtrong contraction of them, when divided?

Why in children.] See §. 30. For their fibres and veſſels are not as yet become callous, as they will afterwards by the activity of life.

In women.] It is certain from anatomy, that the body of a woman is, *cæteris paribus*, much ſofter than of a man. This depends on the will of the creator, who hath ſo diſpoſed the body of a woman, that it might admit of being greatly diſtended without much detriment; to the end that it might contain and nouriſh the fœtus, and accumulate the menſtrual plethora. It contributes much too to this purpoſe, that women in general are not ſo much accuſtomed to hard labour as men.

Idle perſons.] See §. 25. numb. 2. and §. 30.

But the contrary in adults,] becauſe the longer a man has lived, the oftner and the ſtronger have the conſolidating powers been applied to the fibres. A boy has all his limbs flexible and obſequious, but a decrepid old man is ſtiff in every joint; nor can any reaſon be aſſigned why this ſhould hold more in men than in women *cæteris paribus*, but the original frame of the body ſo conſtituted at firſt by the appointment of the creator.

Thoſe who uſe exerciſe.] How much bodily exerciſe contributes to ſtrengthen a weak fibre has been obſerved already §. 28. numb. 2. For that which we call tenacity in the firm parts, is the effect of life continued: the leſs animal motion therefore any one ſuperadds to the vital motion, the weaker his ſolids remain. The man, who does no work with his hands, will have his hands ſoft and tender; but he, who works hard with them, will have them hard and callous, and at length immoveable and ſtiff.

A ſtrong contraction, &c.] When a ſeparation is made in the ſolid part of a living body, the parts divided always retreat from one another, becauſe the power, with which the elements of the fibres cohere, neceſſarily draws back each of the extremities. The ſtronger this power is therefore the greater will the gaping of the ſeparated parts be: hence a wound in a lax body ſoon heals up; whereas in a rigid body wounds gape wider, and are more difficultly conſolidated.

## DISEASES of the leaſt and larger VESSELS.

### SECT. XXXVIII.

THE diſeaſes of the leaſt veſſels, which are made up of ſimple fibres (21, 23) united together by application, interweaving, or contortion, proceeding from the ſame cauſes, have the ſame nature, effect, and cure; and are therefore to be underſtood by what is ſaid from 21 to 38.

The diſeaſes of the fibres being conſidered, and conſequently of all the ſolid parts of the body, ſo far as they conſiſt of fibres, it appears to how great a ſimplicity the diſeaſes may be reduced, which occur in all the ſolid parts.

As then the elementary particles applied to each other conſtitute a ſolid fibre, ſo we may conceive the leaſt fibres to lie contiguous to each other in every point of their adjoining ſides, and thus they will cohere lengthways only. If two ſuch fibres be applied to each other in a parallel direction, they will conſtitute the leaſt membrane that is capable of being formed; if a thouſand of them lying cloſe to each other be united, they will form a broader membrane, but not a thicker. So that the moſt ſimple membrane we can conceive is that which conſiſts of fibres longitudinally united together.

Now the ſtrength of a fibre has been obſerved to depend on the coheſion of its elementary particles; but every elementary particle of a fibre, which conſtitutes the moſt ſimple membrane, coheres with the elementary particles of the two fibres lying next it on each ſide; for which reaſon the ſtrength of a fibre, joined to other fibres on each ſide, is twice as great as it was before in the ſimple fibre by itſelf.

Hence the ſtrength of the fibres increaſes by their being united together in the moſt ſimple membrane. But the fibres, which form the edges of the moſt ſimple membrane, have only by one half a greater force of coheſion in their elementary particles than a ſimple fibre, as they have another fibre contiguous to them on one ſide only.

Now if a membrane conſiſts of fibres interwoven or twiſted together, the ſtrength of the fibres conſtituting the membranes increaſes in proportion as their points of contact increaſe.

From whence it is plain, that that part of the moſt ſimple membrane, which conſtitutes its edge, is moſt eaſily capable of being ſeparated from its coheſion with the reſt.

If ſuch a moſt ſimple membrane be conceived to be turned round into a hollow veſſel, then every fibre will be placed between two others, and there will be no edges at all; the coheſion of all the fibres conſtituting the moſt ſimple membrane thus turned into an hollow veſſel, will be twice as ſtrong as it was in the ſimple ſolid fibre.

Now ſuch a veſſel made by the convolution of ſuch a moſt ſimple membrane, is to be called the leaſt veſſel.

But all the diſeaſes of ſuch a veſſel depend only on the too great or little force, with which the elementary particles of the fibres cohere with one another, and with thoſe which lie next to them. But of theſe we have already treated under the diſeaſes of a ſimple fibre.

## SECT. XXXIX.

THE larger veſſels being compoſed of the leaſt (38) united together by application,

interweaving,

interveaving, or twiſting together, are ſubject to two different ſorts of diſeaſes. The firſt of theſe depends on the diſeaſes of the ſmalleſt veſſels (38), whereof the larger is compoſed, and ſo its origin, nature, effects and cure, muſt be taken from thence (38). But the latter depends, 1. On the force wherewith the fluid flowing through the larger veſſels preſſes upon its ſides by extending them: which ſides, as they conſiſt of other ſmaller veſſels, are deprived of their liquids by this preſſure, have their ſides united, and grow together, in the form of a ſolid fibre, though thicker; which effect may alſo be communicated to the next adjoining ſmall veſſels. 2. From a concretion of the liquid with its own veſſel.

As we have ſeen the fibres united lengthwiſe to have made a membrane, ſo we may conceive the ſmalleſt veſſels, made by the convolution of the moſt ſimple membrane, to be applied to each other, and to make a membrane too; which again convolved will make a veſſel, not of the ſmalleſt kind, but a larger; not conſiſting of ſimple fibres, but of the ſmalleſt veſſels inſtead of fibres.

As then the ſection of theſe ſmalleſt veſſels made perpendicular to their axis is a circle, the ſeveral circles of theſe adjacent veſſels can touch one another only in a point; and conſequently the neighbouring veſſels will touch one another in a line, that is, in a moſt ſimple fibre: the ſtrength therefore of ſuch a membrane, compoſed of the ſmalleſt veſſels inſtead of fibres, will be increaſed in all the ſeveral places of their contact.

The ſmalleſt veſſels therefore will conſiſt of fibres united into a membrane: the next veſſel to this in magnitude, or the laſt but one in ſimplicity, will be that whoſe membrane conſiſts of the ſmalleſt veſſels inſtead of fibres: the laſt but two is not like the laſt but one compoſed of the ſmalleſt veſſels, but of the ſmalleſt together with the ſmalleſt but one; and ſo on 'till you come to the greateſt veſſels in the body, which are compoſed of all the orders of veſſels that are to be found in the body.

The aorta, which is the largeſt veſſel we have, has been proved by injections to conſiſt of membranes made up of leſſer veſſels, though large ones. The membranes of the veſſels conſtituting the membranes, of the aorta conſiſt likewiſe of other membranes, though ſmaller; and ſo on 'till we come to the laſt. Ruyſch has ſhown by his art, that what were judged before to be moſt ſimple ſolid membranes, conſiſt ſtill of innumerable veſſels.

So that the ſtrength of the greater veſſels continually increaſes from the manifold concretion of their ſides; and thus we begin to diſcern upon what the ſtrength and firmneſs of the human body depends.

If then it be aſked, what diſeaſes may occur in the greater veſſels, not upon account of the liquids they contain, but as they are ſolid veſſels? It is plain firſt, that they are liable to all the diſeaſes of the ſmalleſt veſſels whereof they are compoſed; but of theſe we have treated already.

The latter depends, 1, *&c.*] When the aorta is diſtended by the blood expelled from the left ventricle of the heart, the canals are compreſſed, whereof its membranes are compoſed; when the action of the heart ceaſes again, the contracting aorta frees its canals from that compreſſion. But as the ſmalleſt veſſels, which conſtitute the membranes of the greater, are every moment thus compreſſed; they begin by degrees to loſe their liquids for want of ſufficient time for their influx into them: by this means their ſides grow together, their cavity is deſtroyed, and they become a membrane, but thicker and ſtronger: for the coheſion of a membrane convolved into a veſſel was twice as great as that of a ſimple fibre; but when a veſſel is made flat and grows together, there is a concretion of the oppoſite fibres, and the coheſion of ſuch a membrane, formed of flat concreted veſſels, will be much ſtronger than before.

In proportion therefore, as the power of the heart is greater, and the longer it has beat, ſo much the fewer will the veſſels be, and the ſolids the ſtronger; for which reaſon, in very old age, their ſtrength ſhall become immenſe; and at length, when the veſſels, through their too great reſiſtance, will no longer admit of any extenſion from the impelled liquids, an univerſal reſt will enſue, or that fatal, but moſt eaſy, death, which is incident to extreme old age. Thus animals accuſtomed to exceſſive labour, ſhall grow old the ſooner, their veſſels becoming callous before their time.

Thoſe boaſters therefore deſerve to be the object of our mirth, who give out, that they can prevent the wrinkles and inconveniencies of old age, by taking down daily a few drops of an Elixir; ſince it is the inevitable conſequence of an healthy life to make all the veſſels callous, and thereby bring us to our final period.

Medea's method was certainly much more diſcreet, who, by fomenting ſapleſs trunks with warm bathings, obtained the reputation of reſtoring youth to old men (*a*).

2. From a concretion of the liquid with its own veſſel, *&c.*] That is, when the contained liquor is robbed of its moſt liquid part, and it at length grows into one with its own veſſel. It has been obſerved from all ages, that in diſeaſes, where (as the Antients expreſſed it) the innate heat prevailed over the radical moiſture, or where the power of the veſſels exceeded that of the liquids to diſtend them, the blood became liable to run into ſuch pellicular concretions, as a razor would ſcarce cut through. There certainly is a plaſtick quality in our liquids, nor is our food converted into humours, 'till ſuch time as it has attained to it. Ruyſch formed

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(*a*) Palæphatus de incredib. Hiſt. cap. 44.

formed a thick cohering membrane from his own blood, only by beating it up with the branch of a plant called Africana (*b*).

Hence it is eaſy to ſee that the blood, which in acute diſeaſes is already diſpoſed too much to concretions by its inflammatory denſity, when it has loſt more of its moſt liquid part by the violence of the diſeaſe, may poſſibly unite itſelf to its containing veſſels.

But we have an evident inſtance, that even the greater veſſels and their liquids may grow together. For that large canal, which, while we lay in the womb, conveyed blood from the placenta to the liver, grows together afterward, not into a canal folded up as it ought to be if its ſides only collapſed together, but into a kind of round and ſolid chord, which affords us a plain proof that it concretes with its contained liquids.

The ſtrength therefore of the greater veſſels ariſes from three cauſes; 1. From the ſtrength of the fibres. 2. From the collapſed or compreſſed veſſels growing together into membranes. 3. From the veſſels concreting with the liquids they have contained.

## SECT. XL.

HENCE may clearly be underſtood the weakneſs of the veſſels, their laxity, ſtrength, rigidity, elaſticity, which are words that are frequently in the mouths of the ignorant, but are yet of ſuch importance as to deſerve a thorough conſideration.

Theſe have already been all explained, and are recited in this paragraph only as a ſummary of the ſeveral particulars which are to be gathered from this

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(*b*) Theſauro 6. No. 7. & Theſauro 7. No. 39.

ſimple doctrine; and the following chapters will ſhew, that innumerable diſeaſes may be hence both known and cured.

## DISEASES of weak and lax VISCERA.

### SECT. XLI.

THE weakneſs of the veſſels and viſcera we call that coheſion of their conſtituent parts, (23, 38, 39) which may be deſtroyed by ſo ſmall a motion, as to make them incapable of diſcharging the proper offices, which the condition of health and life require of them.

A viſcus or bowel is commonly defined to be an organical part of the body, which by its ſtructure very much changes the humours brought to it, and ſo as to make this change ſubſervient to the life and health of the whole body. Thus the lungs is a bowel that receives the whole maſs of blood, and ſo changes it as to make it fit for paſſing through all the veſſels of the body. So likewiſe the heart receives the whole maſs of blood, and changes it in the direction of its motion and mixture. And the like may be ſaid of the other viſcera.

It is certain now from anatomical injections, that all the viſcera conſiſt of innumerable veſſels diſpoſed in different order in different viſcera; and that on theſe depends the action of the viſcera, whereby they change the humours brought to them. If therefore theſe veſſels be weaker than health requires, they will act leſs upon the fluids they contain, and change them leſs. Thus if the lungs be too weak, they will not be able to change the chyle into good blood. If the liver be too lax in its veſſels, the blood will circulate through it without ſecreting the bile, and a dropſy follow: if the ſtomach fail through weakneſs, the whole affair of chylification will be diſordered.

## SECT. XLII.

WHICH are different according to the difference of age and ſex.

Of age.] All the viſcera increaſe in ſtrength by degrees, according as the vital powers have acted longer on them. Thus in their firſt origin the parts are all ſo tender, that they are almoſt in a ſtate of liquidity; by degrees the body acquires a greater firmneſs, 'till at laſt in extreme old age all becomes hard and ſtiff. Now between this greateſt degree of ſtrength and weakneſs there are infinite intermediate degrees which occur in the different times of life.

And ſex.] For God has appointed it as a law to men, that in the ſweat of their brows they ſhould earn their bread; and to women, that they ſhould conceive, bring forth, and ſuckle children. And this conſtitution obtains even among thoſe nations, who govern themſelves more by the voice of nature than by municipal laws. Now in order to diſcharge theſe offices, a different degree of ſtrength is required in theſe different ſexes.

## SECT. XLIII.

THIS weakneſs ariſes 1. From the weakneſs of the fibres (24) and its cauſes; 2. From the weakneſs of the ſmalleſt veſſels (28) and its cauſes (38); 3. From the ſluggiſhneſs of the liquid flowing through the greater veſſels (39), which may depend on the diminution of its quantity, on its growing too thin and watery, or on the torpid motion of the muſcles; 4. On too great a number of the ſmalleſt veſſels continuing too long incloſed in proportion to the age.

The two firſt of theſe cauſes has been already explained.

3. The action of all the viſcera depends entirely on this, that the liquids, when preſſed by the power of the heart, dilates the arteries; and that theſe preſſing again by their ſtrength and elaſticity propel the diſtending humours: but all ſubſtances retain the longeſt motion once impreſſed, which under an equal bulk contains the largeſt quantity of matter, *i. e.* which are the moſt ſolid.

A certain degree of ſolidity therefore was requiſite in the liquids moved by the heart, that they might not ſo ſoon loſe the motion impreſſed upon them. When this due ſolidity is wanting they are ſaid to be ſluggiſh: this ſolidity of the conſtituent parts of our humours is acquired by the efficacy of the veſſels through which they flow: and this efficacy is that force with which the diſtended veſſels act again on the diſtending humours. When therefore the veſſels are not ſufficiently diſtended through too ſmall a quantity of liquids, their re-action is leſs too, in which caſe the whole ſyſtem grows weak and langid. For this reaſon alſo, when by wounds, or any other cauſes whatſoever, a large quantity of the liquids is drawn off, the food we take down is not converted into ſolid red blood, but all the humours degenerate into and become as thin as water.

On its growing too thin and watery.] Some Phyſicians have been of opinion, that the ſtate of the human body would be then moſt perfect, if our liquids were all extremely thin, and thereby capable of paſſing through the ſeveral canals of the body with the greater expedition: but theſe have certainly miſtaken the original conſtitution of the human fabrick: for correſpondent to the different orders of veſſels, its fluids are of a proportional thickneſs. For were our blood as thin as water, it would ouze away through the open orifices of the veſſels through which we tranſpire, whether ſeated in the internal or external ſurface of the body; or all the cavities of the body would be filled with humours, which however thin would not be thrown into motion. For the thickeſt part of the blood, *i. e.* the red, which in health is always contained in the largeſt arteries and veins, *i. e.* the red, receives the quantity of motion requiſite to life and health from the two moving cauſes the heart and arteries, and communicates it to the reſt. Our heat is produced by the attrition of this red part againſt its containing veſſels; and whenever this red portion begins to fail, the part where it is deficient becomes cold. As we learn from leucophlegmatick people and girls who languiſh under the green-ſickneſs.

For which reaſon the adorable creator hath placed large red veſſels round the medullary ſubſtance of the brain, which collected into the *medulla oblongata*, that thoſe moſt minute veſſels, in which all attrition is wanting, might be cheriſhed with a gentle warmth.

The humours therefore growing too thin and watery may juſtly be ranked amongſt the cauſes why the viſcera are too weak.

The blood of a ſtrong man ſpringing from the vein preſently coagulates into a ſciſſile coherent maſs: bleed a girl in the green ſickneſs, and there flows from the vein a reddiſh, thin, watery ſubſtance, which will hardly coagulate at all.

The torpid motion of the muſcles.] This has been treated of already §. 25. numb. 2.

4. It is abſolutely certain, that a due degree of calloſity is required in every different age, and the abolition of ſome of the veſſels. Anatomiſts obſerve, that injections are performed with the moſt happy ſucceſs in younger bodies. Thus we ſee, that as age increaſes many veſſels are deſtroyed.

The gland thymus, which is ſo remarkable preſently after the birth, is ſo diminiſhed in an adult, as to leave ſcarce any mark of it behind. A woman who has ſuckled many children ſucceſſively, from her plentiful fountains of milky nectar, when grown old and ſcraggy, ſhall have nothing left but her wrinkled ſkin, which ſcarce deſerves the name of breaſts. The ſcattered glands of the meſentery are quite ſhrunk up to nothing in men in an advanced age.

For it adds very much to the ſtrength of the firm parts of the body to have many of the ſmalleſt veſſels compreſſed and concreted into ſtronger membranes: but this concretion is owing to the ſtrong motion wherewith the fluids are carried through the veſſels: the ſtronger therefore this motion is, or the longer it has laſted, the greater is the conſolidation of the body. And hence in a perſon juſt born there is a very great number of veſſels, but a lax habit of the whole body: whereas in an adult, many of the veſſels are deſtroyed, and there is a greater firmneſs.

## SECT. XLIV.

FROM this weakneſs (41) produced by the forementioned cauſes (43) ariſe many diſeaſes, which are falſely imputed to a bad conſtitution, or ſuppoſed to be born with us; whereof the principal are, the eaſy dilatation and ſwelling of the veſſels; an eaſy compreſſion of them and inanition; a ſtagnation of the liquid contained in them; an increaſed reſiſtance to the motion of the heart; a crudity of the liquids; their ſpontaneous corruption; unfitneſs to perform the vital, natural, and animal functions, with all the conſequences following from hence, which as they are infinite in number, ſo are they likewiſe moſt difficult to cure, and moſt fruitful in producing new diſeaſes; eſpecially a cachexy and cacochymy; 2. The eaſy rupture of the veſſels by internal or external cauſes, proceeding either from acrimony or violence of motion; the effuſion, ſtagnation, corruption, evacuation, of the liquid neceſſary to life and health; the intercepted motion of the fluids by means of the broken veſſels; the corruption of thoſe fluids, whoſe ſound ſtate depended on that motion; which are likewiſe various, and chiefly a pthiſick, empyema, dropſy, atrophy.

Here again a body that was ſound before is ſuppoſed to be rendered too weak in its veſſels and viſcera; and then will the changes wrought in its diſordered functions plainly appear, and more eſpecially the following.

Upon its being obſerved that the health of each particular man contained in it ſomething ſingular and peculiar to himſelf, and at the ſame time that different bodies were as different from each other, both in the ſolids and fluids, though all equally in health, this ſingular conſtitution of each particular body, wherein it differed from another equally healthy, was termed its idioſyncraſy; and the faults which depended upon it were deemed incurable, as they were judged to pertain to the body from its firſt formation: and yet we are not to impute theſe diſeaſes of too weak veſſels and viſcera at all times to their original formation.

A young lady of family is delicately brought up, and under a lazy life her little body grows weak and languid: whilſt a country girl of a reſembling make, in the early part of her days, by being accuſtomed to labour from her infancy grows ſtrong and hardy.

The weakneſs to which the former is ſubject, with the diſeaſes depending upon it, would be unjuſtly ſuppoſed to have been originally conſtitutional.

Let a very ſtrong man loſe a large quantity of blood by a wound, and in conſequence of it fall into a dropſy, and we ſhall find a wonderful change in what is commonly called the conſtitution.

Whereof the principal are, the eaſy dilatation and ſwelling of the veſſels.] It has ever been a queſtion from the very infancy of phyſick, how the viſcera concoct their humours, nor has much been ſaid to the purpoſe, 'till Ruyſch demonſtrated that there is every where in all the different viſcera a different conformation at the extremities of each artery; and the viſcera ſeem deſigned to have given ſupport to this conformation. If now the arteries become too weak in any of the viſcera, they muſt neceſſarily be the more dilated; as the ſame force of the impelled liquid muſt in this caſe diſtend the ſides of the veſſels with leſs reſiſtance: for which reaſon the weakened viſcera will not prepare the ſame humours as in health, but ſuch as are quite different, to the diſordering of the whole body. Thus as ſoon as the ſtructure of the liver is changed, the liquid ſeparated by it is no longer bile, but a very different liquid of a much worſe nature, as we learn from undoubted obſervations. So the veſſels of the kidneys when relaxed will tranſmit blood inſtead of urine.

The dilatation of the veſſels will alſo cauſe a humour of the whole or a part: for in thoſe that have weak veſſels and viſcera, the face is puffed up, the cheeks bloated, the whole body fungous, like the body of ſilkworms when about to ſpin out their threads. And thus we ſee ſuch people, while the diſeaſe is gradually creeping on them, are often apt to pleaſe themſelves with the thought of their growing plumper.

An eaſy compreſſion of them and inanition.] The veſſels of a ſtrong man of themſelves indeed will contract ſo as to leſſen the diameter of their cavity, but do not fall flabby together; on the other hand, they ſtrongly reſiſt all contraction greater than is natural. Preſs a dropſical leg and it will pit; but in a healthy and robuſt man the part preſſed ſhall preſently riſe up again.

Stagnation of the liquid.] For the whole force of the heart almoſt is employed in dilating the arteries:

now if theſe are ſo weak, that when they are diſtended by the blood impelled by the power of the heart they do not ſufficiently contract, the blood will remain unmoved in the dilated veſſels: for there are two cauſes, which produce the motion of our liquids through the canals: 1. The power of the heart diſtending the veſſels by the blood impelled into them; 2. The ſtrength and contractility of the veſſels, which when the motion of the heart ceaſes, propel the blood that was thrown into them by the heart: when therefore this contractility of the veſſels is deficient, the liquids ſtagnate.

The reſiſtance of the motion of the heart increaſed.] This perhaps may ſeem ſtrange, ſince the debilitated veſſels will more eaſily give way to the blood impelled by the heart; but if the debilitated arteries do not contract with a ſyſtole ſufficiently ſtrong, they continue diſtended and full; for which reaſon the very next moment the heart cannot ſo eaſily pour out its contents into the veſſels, as they are already too much diſtended and full. We daily ſee very pale and bloated perſons well enough while they lie ſtill and motionleſs; but upon the leaſt ſtirring they pant and blow, the heart throbs, the jugular veins ſwell, and they ſeem almoſt in danger of being ſuffocated: for while they remain quiet, the venal blood is brought to the heart with a ſlow motion and in a ſmall quantity, which is again expelled; but when the celerity of the venal blood is increaſed by the motion of the body, the heart is not able to propel the blood ſo faſt as it receives it through the veſſels, which are already full.

Crudity of the liquids.] Whatever food we take down, it is called crude, as being of a nature foreign to our liquids, 'till it is digeſted by the vital powers. But if the viſcera be weakened, their reſpective powers by which they conſpire to change the food we take down into our own nature, periſh. For to make the chyle good, it is requiſite that all the viſcera, whoſe office it is to aſſiſt in the formation of the chyle; ſhould ſupply it with the humours which they prepare; it is therefore requiſite that theſe humours ſhould be duly prepared: if then the viſcera are weakened, the humours will be ſuch as decline from their proper nature; and thus the whole buſineſs of chylification will be diſordered. Thus the weak body of a young woman labouring under a chloroſis is not capable of producing good blood, even from the beſt ſort of food; but inſtead of it forms a pale kind of humour reſembling a little blood mixed with a great deal of milk: and from hence follow wonderful degenerations of the humours, and of conſequence various and ſtrange kinds of diſeaſes. All the viſcera contribute their part to change the aliments into our nature; if one or more of theſe therefore be debilitated, the aſſimilation fails, and a ſubſtance of a different poſition is produced.

Galen well adviſes (*a*), that in reſtoring weak people, we conſider, *nutrimentum ſeipſum non concoquere nec in partes diſtribuere, nec alendi partibus aſſimilare*, &c. "that the aliment does not concoct itſelf or diſtribute "itſelf into the parts, or aſſimilate itſelf to the part "that is to be nouriſhed."

Spontaneous corruption.] The food we take down is changed and aſſimilated into our own nature by the whole action of all the veſſels and viſcera; this change is called πέψις, concoction. But if the food we take down be of ſo tenacious a nature, or the powers of the body ſo weakened, as not to be able to digeſt it, then though it is changed indeed in the body, it is not aſſimilated into our nature, but ſtill retains its own diſpoſition, whereby if it be kept in a warm and moiſt place it ſhall turn ſharp, putrid, rancid, *&c.* this is called ſpontaneous corruption. An example will explain my meaning. The ſtrong viſcera of a reaper ſhall produce good blood from rye-bread; and yet this bread, if depoſited in a chemical veſſel, and placed

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(*a*) Method. Med. Lib. VII. cap. 6. Charter. Tom. X. pag. 163.

placed in the ſame degree cf heat with that of our body, and a little water be added to it, will change into the worſt kind of acid; but his ſtrong viſcera ſhall overcome this tendency to acidity; let a weakly girl eat of it, and it ſhall retain its own nature, and growing acid bring on the heart-burn, griping pains, *&c.*

This change for the worſe in a weak body is not indeed wrought entirely in the ſame manner as out of the body; but yet if the aſſimilating power of the human body does not prevail, the aliment always has a tendency towards this ſpontaneous change.

Ineptitude to perform the vital and animal functions, *&c.*] All the functions of the body in ſome ſort depend on muſcular motion; for the moving cauſes of all the humours, *i. e.* the heart and arteries, are all muſcular: which functions cannot be performed without good ſpirits; as ſpirits cannot be prepared without the laſt and moſt perfect aſſimilation.

When therefore the viſcera are too weak to elaborate the aliment to the laſt and greateſt degree of perfection, that moſt ſubtle part, on which every thing in the body almoſt depends, begins to fail. Thus when a ſickly girl begins to languiſh under a chloroſis, an unuſual torpor creeps on by degrees, with great laſſitude from the leaſt motion, giddineſs, and dulneſs of all the ſenſes, all which indicate that the animal faculties are diſordered; the palpitation of the heart after the leaſt motion, the ſoft weakly pulſe, and ſhortneſs in drawing the breath, ſhew the weakneſs of the vital actions; the languid or wonderfully depraved appetite, the great uneaſineſs after eating, the frequently coſtive habit, and the pale crude urine, ſhew the depravation of the natural functions.

And hence it eaſily appears, that numberleſs diſeaſes may ſpring from this fountain, whilſt all the functions of the body are by this means thus capable of being diſordered; and from hence alſo we may eaſily diſcern the difficulty of a cure; for before this effact can be obtained, the deficient ſtrength of the ſolids muſt be reſtored : but this cannot be done, unleſs ſo much of the original nature remains in the body, as when freed from impediments, and furniſhed with what is wanting, may be able to form good blood out of that which is not blood, that is, from the food. Thus, for inſtance, if the lungs or liver be waſted, it is in vain to expect help from medicine.

But to this cauſe more particular is owing a

Καχεξία.] An ill habit (of which hereafter in a chapter by itſelf) is a weakneſs of ſuch a nature, as to occaſion a diſordered and depraved nutrition through the whole habit of the body at once. This cachexy is produced, when all the liquids and ſolids deviate from the conditions required to form an aſſimilation : every cachexy neceſſarily has with it a κακοχυμία; that is a degeneration of all the humours from the conditions required in health : for our humours receive their properties from the power of the veſſels and viſcera ; if theſe therefore be too weak, the humours muſt neceſſarily degenerate.

2. The eaſy burſting of the veſſels.] Such a degree of coheſion is required in the ſolid parts that conſtitute the canals of the body, as may be able to ſuſtain the force of the liquid impelled by the power of the heart, without a breach of their continuity. But when this coheſion is weakened, there is a danger of a rupture from the liquids being impelled with too great a force : thus thoſe melancholy accidents ſo frequently occur, when men of tender conſtitutions have attained to their full growth, and their veſſels being either naturally too weak, or not ſufficiently ſtrengthened by muſcular motion, that upon calling out aloud, or ſinging, or running, an artery ſhall burſt in the lungs, and they vomit out their blood and life together, or elſe ſhall afterwards pine away in a ſlow conſumption. So thoſe that who have the veſſels of the kidneys very weak, ſhall often make bloody urine when carried roughly in a coach over ſtony ways.

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It has farther been obſerved, that when the veſſels are weakened, the humours degenerate into a ſpontaneous corruption, in which caſe they conſtantly become more acid: for our humours in health are of ſo mild a nature, that ſound blood dropped into the eye ſhall give no pain: when therefore acrid humours flow through weakened canals, they will eaſily break through them. This we ſee in the ſcurvy, where a laxity of the whole body and acrimony of the humours oftentimes concur, in which caſe a rupture of the veſſels and effuſion of the blood under the ſkin occaſion the ſpots that are ſo remarkable in this diſeaſe.

When the veſſels are thus eroded by the acrid liquid, or broken by the too great violence of its motion, the humours they contained flow out; and when extravaſated, ſtagnate, as they want the moving cauſe; and when they ſtagnate they turn to corruption, ſlowly indeed, as the air has not free acceſs to them, but yet they putrefy. When the liquids iſſue out of the broken veſſels, the circulation of the humour is diſcontinued, becauſe of the rupture made in the veſſels; and of courſe all the functions, which depended on the motion of the humours through ſound veſſels, are deſtroyed. For which reaſon, as this may happen in divers parts of the body, numberleſs diſeaſes may ariſe, which though not eaſily to be reckoned up, may be reduced to certain claſſes, whereof the principal are theſe that follow.

Φθίσις, a phthiſis.] So called from φθίνω to corrupt. But the word is not uſed now among Phyſicians to denote every corruption, but to expreſs a conſumption of the whole habit of the body from a prevailing purulent cacochymy, be the ſource of it in any part of the body whatſoever. When the too weak veſſels are eroded or broken, the humours extravaſated corrupt and inflame the parts about them through their acrimony. Thus blood collected in the cavity of the breaſt inflames the lungs which it touches; this inflammation is followed by a ſuppuration, and deſtroys the man by a true conſumption of the lungs. Thus we eaſily diſcern how an empyema may be cauſed, which in a larger ſenſe ſignifies every ſuppuration, but is commonly taken for a collection of pus in the cavity of the breaſt.

Ὕδρωψ, a dropſy.] All thoſe who have this diſeaſe creeping on them by degrees, labour under a weakneſs of the veſſels and viſcera; and every dropſy that does not ſpring from ſome other preceding violent diſeaſe, has commonly this for its cauſe. For the tranſpiring arteries tranſmit their humours into every cavity of the body both great and ſmall; but it has been obſerved, that the power, wherewith the very ſmall orifices of the veins ſuck in the humours thus tranſmitted from theſe cavities, increaſes and decreaſes in proportion to the ſtrength of the circulation: for which reaſon in acute diſeaſes, where the circulation is too great, every part is dried up: and in languid chronical diſeaſes an univerſal tumour ſucceeds by means of the gradually accumulated humours. To which we may add, that in very great weakneſſes the evacuating power of the artery ſeems to endure longer than the abſorbing power of the vein: ſo that in every ſtate of the body, where the vital vigour diminiſhes, the watery humours begin to be accumulated.

Ἀτροφία, atrophy.] At firſt ſight this ſeems to be an evil oppoſite to the former; but when the abdomen is become tumid to an exceſſive degree by means of an aſcites, we ſee all the parts above grow leſs; and no wonder, ſince when the bowels are too weak, they cannot contribute their reſpective offices towards the laſt and moſt perfect concoction of the aliments, by which they are changed into our nature, and the loſt parts reſtored: for life would of itſelf deſtroy the body, unleſs it was repaired by the food we take down. Nutrition may therefore become defective through this cauſe only; and this deficiency is called an atrophy.

## SECT. XLV.

WHICH (41, 42, 43, 44) if any one accurately obſerves, he will diſtinguiſh the original, the preſence, the event, not of this (41) diſeaſe only, but of abundance of others too, and thoſe the moſt obſcure, and will ſolely diſcover the effectual and ſafe means of obtaining a cure.

Whoever attentively conſiders what we have ſaid above, will eaſily conclude, that all the functions of the body may be injured by the debilitated action of the veſſels on the contained fluids; becauſe the ſoundneſs of them all depends on the action of the ſolids on the fluids, and of the fluids on the ſolids; and conſequently, that this is the true ſource from whence a great number of diſeaſes take their riſe. Where then the effects of diſeaſes derived from weakneſs are obvious to the ſenſes, there can be no difficulty in knowing the cauſe; but oftentimes the moſt hidden diſeaſes owe their origin to this cauſe only. If the too weak veſſels of the lungs break and throw out a crimſon ſtream of bright and florid blood, it is eaſily known, that a preceding weakneſs has been the cauſe of this diſaſter. But if the reſembling ſmall arteries in the brain ſhould break, and by the effuſion of the blood they contained bring on a mortal apoplexy, the latent cauſe of this grievous malady will be ſtill the ſame. If the veſſels of the liver break and extravaſate their humours, which putrefying by ſtagnation inflame the parts adjacent, and at length after a ſeries of painful ſuffering conſuming the whole ſubſtance of the liver occaſion certain death; the firſt origin of this diſorder depends on the ſame cauſe. And ſo of all the other viſcera.

There ſeems to be no better rule in the practice of phyſick than this, that in curing diſeaſes we ſhould always conſider the firſt cauſe from whence every other dircumſtance has flowed; for from this ſource only can be deduced any certain and effectual method of cure. They who attempt to cure a dropſy from weakneſs by cleanſing the body with purges, wonder to ſee it grow juſt as tumid as before within a few days, whilſt every humour flows into the flaccid veſſels, and ſcarce any part of the liquids we take down is carried off by ſweat or perſpiration, and very little by urine. Whereas they that are ſo diſcreet as to inveſtigate the firſt cauſe of this diſeaſe, after they have removed the diſtending load, will be careful to ſtrengthen the lax body with bandages, and by a dry diet, corroborating remedies, and due exerciſe, will conquer the firſt cauſe of the diſeaſe from whence every other part of the miſchief flowed.

## SECT. XLVI.

BUT in the application of theſe, the preſent weakneſs requires us to proceed ſlowly, as a ſudden change can in no caſe whatſoever be attended with greater danger.

The judicious Hippocrates condemns ſudden changes in all diſeaſes whatſoever, ſaying (*a*), *quod paulatim fit, tutum eſt, tum alias, maximè ſi quis ab altero ad alterum tranſeat*; "that what is done by degrees is "ſafe at all times, but eſpecially when the tranſition "is from any one ſtate to a ſtate quite different." This general rule is more eſpecially to be obſerved in the cure of weak veſſels and viſcera. Should any one in this caſe imprudently accelerate too much the motion of the humours through the veſſels, either by ſtimulating medicines or an increaſe of the muſcular motion, the too weak veſſels and viſcera would generally break, as unable to ſuſtain the additional force, and inſtead

(*a*) Aphor. 51. Sect. 2. Charter. Tom. IX. pag. 88.

inſtead of relief, death would be the conſequence, through the wretched miſtake of the Phyſician.

Whoever ſhould treat a man labouring under an hæmoptoë, from weak lungs, with ſtrong exerciſe in the firſt place, would only cauſe the wound, that is not yet conſolidated, to break open again by the accelerated motion of the blood: ſo that in this caſe we ſtand in need of the greateſt caution, and in prudence are obliged to proceed very ſlow.

## SECT. XLVII.

REmedies therefore (28) are to applied ſlowly, cautiouſly, from the mildeſt to the moſt efficacious; and when the veſſels are ſtrengthened by the uſe of theſe, ſtrong muſcular motion is to be continued, 'till it is certain from all appearances, that the veſſels and viſcera are become ſufficiently compact, ſolid, and callous.

Whatever has been ſaid concerning the cure of a fibre when too weak might here be repeated. But we muſt be particularly careful to proceed gradually, 'till health be reſtored. If we attempt to cure theſe diſeaſes by muſcular motion, we muſt begin with the moſt gentle, then by degrees and cautiouſly increaſe it, continually having in view the effect produced by this motion in the body of the ſick. If, in a dropſy ariſing from the weakneſs of the veſſels only, the patient ſhould be directed to uſe violent motion, the conſequence would be ſuffocation: but if the quantity of the diſtending waters be diminiſhed, the lax parts be ſtrengthened by bandages, and medicines moderately warm be firſt adminiſtred, and then ſtronger, and the patient after this be directed to uſe gentle motion, and increaſe it by degrees to the moſt violent; we may be aſſured, that the body will by this means be ſtrengthened, and the diſeaſe conquered.

But it is not enough to conquer the diſeaſe; we muſt alſo remove the cauſes from whence it has proceeded, without which it is eaſy to foreſee that it will certainly return. For when you have carried off the waters collected in an hydropical perſon, you have only reſtored the body to the ſtate it was in before it grew dropſical of itſelf: ſo that the parts which then were lax ought now to be ſtrengthened.

But how ſhall we be able to diſtinguiſh, whether the compages of the viſcera, that was before too weak, is now grown ſufficiently ſtrong? If an equable and healthful heat be diſcernible through the whole body, for in weak people the heat fails; if after drinking the body ſwells neither univerſally nor in any particular part; but more eſpecially if there be a lively red colour to be ſeen in every part, where the veſſels are conſpicuous, as not being covered by the ſkin, ſuch as the lips, tongue, fauces, gums, corners of the eyes; for from theſe circumſtances we may ſafely conclude, that the veſſels and viſcera have attained to their due ſtrength.

When the cure is thus far advanced, it is by no means requiſite to ſtrengthen any farther; leſt we ſhould bring on the oppoſite diſeaſe of too great rigidity: the body is only to be preſerved in the degree of ſtrength which it has acquired, and all thoſe particulars carefully avoided, which have been ranked among the cauſes of too great weakneſs; otherwiſe the diſeaſe will ſoon return. This is what we frequently complain of in young perſons of the female ſex, lately cured of the green-ſickneſs; for whilſt they cannot be prevailed with to refrain from ſipping warm liquors, and had rather loſe the ſtrength they have gained by ſloth and indolence, than preſerve their health by exerciſe, they not only give more trouble than is neceſſary to their Phyſicians, but bring upon themſelves at laſt an incurable diſeaſe.

## SECT. XLVIII.

HENCE it appears, that what has been delivered concerning the virtue of aliments, is in ſome reſpects true, and in others falſe; that the exerciſe of the muſcles ſtrengthens the fibres; that the exerciſe of carriage diſſolves what is coagulated, and ſtrengthens what is relaxed, without loſs of ſtrength; that the blood and gore is very thick, heavy, and ſmooth, in very ſtrong people; but in ſuch as are very weak, it is broken, light, acrid; that abundance of diſeaſes, in appearance very different, may ſpring from the ſame root, which being removed they will ceaſe of courſe.

That what has been delivered of the virtue of aliments *&c.*] Such as have wrote of aliments in an abſolute ſenſe, can never poſſibly make obſervations, which will hold good in all caſes; becauſe the virtue of the aliment depends not ſolely on the aliment itſelf, but more eſpecially on the agents employed in its digeſtion; (ſee §. 25. numb. 1.) Whole nations have lived on vegetables and water only; others almoſt wholly upon fiſh and water; others on all thoſe ſubſtances mixed together, which the earth produces of its own accord, or is made to produce by art, or which are ſupplied by the ſeveral parts of animals, as luxury has invented; yet theſe have all enjoyed a tolerable ſhare of health, or moſt of them at leaſt; nor has the variety of aliment occaſioned any great difference in this particular. For there is ſuch a faculty in the human body, that, by the conſpiring action of all the veſſels and viſcera, it is capable of forming human blood out of very different aliments, which in all its own properties ſhall be very nearly the ſame. And yet the ſame kind of aliments ſhall be capable of doing good or harm according to the different ſtrength of the veſſels or viſcera. Fleſh-meat ſalted and dried by ſmoke, with very coarſe bread, ſhall ſuit well with the hard viſcera of a plowman: were you to feed him with nothing but broths, he would ſoon grow faint and languid; and yet theſe are ſerviceable to weak people, who, on the other hand, are not able to take down ſuch coarſe food without detriment (*a*). *Qui copioſos cibos conficere queunt, illis ſorbitiones ne dederis, cibum enim excludunt, qui verò non poſſunt, his dato*; "Give "not ſpoon-meats to thoſe who can digeſt much meat, "for they paſs off too ſoon, but agree well with "weaker ſtomachs."

No food therefore is to be called wholeſome in general, and he that ſhould aſk, what food is wholeſome, might as well aſk, what was the beſt wind without ſaying whither he was bound.

The exerciſe of the muſcles, *&c.*] Of this ſee §. 25. numb. 2. and §. 28. numb. 2. For by muſcular motion only too plentifully uſed, the oppoſite diſeaſe of too great rigidity may be brought on. What an immenſe difference is there between the fleſh of an ox, fatted in the ſtall, and of one that by hard labouring at the plough has hardly any juices left within him.

The exerciſe of being carried, *&c.*] Muſcular motion ſtrengthens the body but fatigues it too, and deſtroys the ſpirits as much as it gives them; ſo that to cure very weak people by this means is abſolutely impoſſible. Inſtead of this motion therefore weak people ought to be carried; and at firſt indeed in a very gentle manner, as by ſwinging on a rope with a ſlow oſcillatory motion (*b*): after this it may not be improper to he carried in a litter; then in an eaſy chariot or chaiſe; afterwards in a coach upon the common roads and ſtreets; and laſtly on horſe-back, riding ſometimes harder and ſometimes more ſlowly. Thus are the moſt difficult diſeaſes to be cured, and the patient

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(*a*) Hippoc. de effect. cap. 12. Charter. Tom. VII. pag. 633.

(*b*) Mercurialis de arte Gymnaſticâ, pag. 247.

patient has well nigh every advantage of muſcular motion without almoſt any the leaſt loſs of ſpirits. Theſe exerciſes are all of them more eſpecially ſerviceable on theſe three accounts; 1. As the pendulous viſcera receive ſtrength from theſe agitations, and the ſeveral concretions formed in the humours are partly broken by the concuſſion, and partly by the increaſed powers of the veſſels and viſcera. 2. As the remaining fæces of the laſt digeſtion are hereby diſcharged from the *primæ viæ* in ſuch perſons, as would otherwiſe retain them, through want of power in theſe viſcera to diſcharge them: for which reaſon exerciſe is particularly adviſeable an hour or two before a meal. 3. As the force and efficacy of the air on the veſſels of the lungs is hereby increaſed, and the ſurrounding atmoſphere, which preſently grows warm with the heat of the body, is continually renewed; which more eſpecially is obtained by riding on horſe-back.

That the blood, *&c.*] We call that denſe blood, which has the greateſt weight under a given meaſure; but this depends on the preſſure of the veſſels. For every thing almoſt that we take down, as likewiſe the chyle and milk prepared from it, are lighter than blood. Blood extravaſated, and free from the compreſſion of the veſſels, becomes lighter than it was, whilſt within the veſſels. The blood therefore is ſo much the more compact and ſolid, as it is more conſolidated by an increaſed ſtrength in the veſſels; and for this reaſon in acute diſeaſes, where the action of the veſſels on the contained humours is too great, the blood becomes more ponderous and denſe. Blood ſpringing from a vein or a wound in a very ſtrong man is thick and black; hence Homer ſays (*c*), when Ajax wounded Hector, *the black blood ſprung forth*: and elſewhere he ſpeaks of the black blood of his heroes (*d*). But there is likewiſe a lentor in ſuch blood, by which it preſently forms itſelf into a ſolid maſs.

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(*c*) Iliad. Lib. VII. pag. 124. μέλαν δ' ἀνεκήκιεν αἷμα.

(*d*) Ibid. pag. 26. τῶν νῦν αἷμα κελαινὸν, &c.

This is always the caſe of arterial blood in ſtrong men: but after violent labour, or in acute inflammatory diſeaſes, the venal blood too coagulates in the ſame manner almoſt immediately. In ſuch blood alſo there is this property, that if it be applied to a ſound eye, it will give no pain; ſo mild is ſound blood, (and yet there is ſomething of a brackiſh taſte in it, though greatly diluted) ſo as to give no offence by its acrimony to parts of the moſt acute ſenſe: for whatever is bred in the blood, that is of too acrid a nature, is carried off by urine, ſtool, ſweat, *&c.*

In ſuch as are very weak it is broken, *&c.*] It is difficult to examine the blood of a ſound man hydroſtatically, becauſe it immediately coagulates and rarefies when freed from the preſſure of the veſſels. And yet Mr. Boyle, to get ſome information in this matter, though not very accurate, (as himſelf confeſſes) (*e*) received the blood of a ſound man in an oblong phial; and when it had ſtood quiet, and the bubbles were gone, he marked its height with a diamond; then waſhing out the blood, he filled the ſame glaſs with water to the ſame height, and then found that the ſpecifick gravity of good blood exceeds that of water about a twenty-fifth part: but from what we have obſerved it is plain, that the power of the veſſels and viſcera forms a blood from the aliments which is more ſolid, and conſequently more heavy, than the aliments themſelves: for which reaſon, as this power is languid in very weak people, the blood in them is leſs conſolidated, and conſequently more broken and light, 'till at length it becomes as thin as water. This we learn by a dropſy, which will ſometimes ariſe from inactivity and weakneſs only.

But a more than ordinary acrimony generally accompanies too great a thinneſs of the blood; whence eroſions of the weak veſſels eaſily happen in very tender people, as alſo ſpitting of blood and diſorders of the

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(*e*) Hiſt. ſanguin. human. p. 11.

the like kind. And for the ſame reaſon theſe perſons are ſo frequently ſubject to ſharp and ſalt catarrhs.

Abundance of diſeaſes, *&c.*] While the human liquids flow through canals of a proportional diameter, and every decreaſing ſeries of liquids is carried in its proper veſſels, the ſeveral functions of the veſſels and viſcera are duly diſcharged. When the debilitated veſſels are too much diſtended by the impelled liquids, and admit foreign humours, the conſequence is nothing but diſorder; this ſimple cauſe may be the origin of numberleſs diſeaſes; and all the diſeaſes from this cauſe be removed, by reſtoring the natural ſtrength of the veſſels. One example ſhall ſuffice out of innumerable that might be alledged. The *tunica adnata* of the eye has naturally no red blood in its veſſels; but if theſe by any cauſe be relaxed, the red blood enters, and remaining in them, brings on an ophthalmia, which at firſt is oftentimes to be cured by the application of cold water, by which the veſſels being contracted repel the red blood that was in them, whereas the application of emollients and laxatives would increaſe the diſeaſe.

This ſhews the great uſe of conſidering this ſimple diſeaſe, as it prepares the way to underſtand and cure others that are very intricate, which depend on the ſame origin.

## SECT. XLIX.

FROM the ſame principles the knowledge and cure of laxity of the veſſels and viſcera is to be drawn.

Since laxity is one kind of weakneſs, as has before been obſerved, whatever has been already advanced may be applied to it.

The

# The DISEASES of too ſtrong and rigid VISCERA.

## SECT. L.

TOO great rigidity of the veſſels and viſcera is ſuch a coheſion of the parts (23, 38, 39) whereof they are made up, as does not yield to that degree of motion, which ought to move and change them, in order to produce the effects which depended upon that mutability in the time of health and life.

During the whole time of our life the veſſels of the body are changing, ſince they never continue two moments in the ſame amplitude, but are one while diſtended by the force of the liquid impelled from the heart, and again contracted in all their dimenſions by their own ſtrength. Such a coheſion therefore is required in the conſtituent parts of theſe veſſels, as that they may readily give way: but if this coheſion be ſo great, as to hinder them from yielding, or not ſufficiently, it is the diſeaſe of too great rigidity in the veſſels and viſcera.

What the viſcera are has been already obſerved §. 41. and it was alſo obſerved there, that all the viſcera produce their peculiar effects by the fabrick of the veſſels whereof they conſiſt: but all the veſſels act only on the fluids, whilſt they contract and endeavour to leſſen their own diameters: and when theſe are once contracted to their ſmalleſt diameter, then their power ceaſes, and acts not again, unleſs the veſſels be again diſtended by the impelled liquid. There is required therefore ſuch a flexility in the veſſels, as that they may yield to and be expanded by the impelled liquid;

liquid; and then, when the impelling force ceaſes, contract themſelves again.

It is farther required in all the viſcera, which are ſo contrived as to ſecrete proper liquids through emiſſary ducts, that the laſt of the ſecretory canals ſhould have a certain and determined ſize; leſt they let go what ought to be retained, or retain what ought to be ſecreted: and on this due proportion life and health entirely depend.

There is required beſides a different flexility in the different viſcera of the body; much greater certainly in the fine arteries of the cortical ſubſtance of the brain, than in the ſecretory veſſels of the kidneys: for which reaſon nothing here can be determined in general, but with limitation, to the various uſes which health requires.

## SECT. LI.

IT ariſes, 1. From all the cauſes that produce too great a ſtiffneſs of the fibres (32); 2. Eſpecially from the fibres being too violently compreſſed together by the force of the propelled vital liquid; 3. From the union of the leſſer canals deprived of their liquid by the violent preſſure, with which the arterial vital liquid preſſes the ſides of the greater canals, whereof the principal efficient cauſe is a muſcular motion much uſed; 4. From a concretion of the veſſel with its own liquid, either ſtagnating, dried up, or coagulated.

1. Theſe have been treated of §. 32.

2. Though there ſhould be parts in the liquids adapted to the reſtoring of the elementary particles rubbed off, and waſted by the actions of health; yet it is required (as was remarked in the cure of a weak fibre) that theſe ſhould be applied to their reſpective

places by the propulſion of the vital liquid, and in a manner united by preſſure to the other elementary particles; which action, the ſtronger it is, the firmer is the ſtructure of the fibre thereby made or repaired. Now the ſame power, that joins the elementary particles of the fibres together, preſſes the fibres, which are compoſed of them thus united, more ſtrongly toward each other, and makes their coheſion the greater.

3. This has been treated of §. 39. numb. 1. For the membranes of the larger veſſels are made up of ſmaller veſſels: but the ſmalleſt veſſels are much leſs diſtended by the power of the heart than the greater, upon which the heart acts in a manner with its firſt force, and its powers entire: for which reaſon, when the greater canals are diſtended, the ſmaller veſſels, which conſtitute the membranes of the greater, are made flat and impervious, whereby they grow together, and their ſtrength is increaſed. Now muſcular motion much uſed increaſes the motion of the heart, by moving the venal blood more ſwiftly towards it; from whence follows a greater impetus through the larger veſſels, with all the other conſequences already mentioned. And this is the chief reaſon why muſcular motion ſtrengthens weak bodies ſo well.

4. This has been treated of §. 39. numb. 2.

## SECT. LII.

WHEN this takes place in the veſſels, it produces, 1. Either the ſame or reſembling effects with thoſe that proceed from too ſtiff a fibre (33); 2. It produces a ſtrong tendency in the fibres of the veſſels to approach towards the axis of their reſpective canals; to contract their cavities; to preſs, compreſs, repel, expel, their liquids; and hereby to reſiſt their protruſion from the heart, and of courſe the action of the heart itſelf; to be more difficultly dilated, and hereby to interrupt the equable motion of the blood and conſequently of all the ſecretions, to diminiſh the quantity of the blood which would otherwiſe be thrown from the heart at every time of beating; to hinder the heart from emptying itſelf entirely; to produce polypus's of blood; and by compreſſing the fluids, and robbing them of their moſt fluid parts, to condenſe it and bring on ſuffocations and death. 3. If there be any wounds in the veſſels, it cauſes them to gape wider by means of the ſtrong force wherewith the parts of the veſſels are drawn towards the particles, whereto they cohere; if they be cut aſunder, it diminiſhes or quite cloſes the orifices at their extremities.

1. Of theſe we have treated already.

2. A line drawn from the apex of a conical canal to the center of its baſis, is called its axis. Whilſt our flexible canals are diſtended by the impelled liquid, they are in a ſtate of violence, and the longitudinal fibres, which are dilated into an arch, endeavour to return to their former length: the orbicular fibres alſo when diſtended endeavour to return into ſmaller circles. By both theſe actions the ſides of the canals are drawn nearer to their axis: which is the ſole action of our canals, ſo far as concerns the endeavour of the fibres to reſtore themſelves. Now it is evident, that as the firmer the ſtructure of the ſides is, and the greater their elaſticity, ſo much the ſtronger will this endeavour be.

But whilſt the ſides of a canal approach nearer to each other, the cavity muſt neceſſarily be diminiſhed, and the contained liquid the more preſſed: but ſince the liquid cannot be expreſſed ſo faſt though the converging extremities of the arteries, nor be driven back to the heart, (for that the valves of the aorta will not admit of) it muſt be compreſſed, repreſſed,

and

and condenſed: for all bodies that are both porous and flexible will be reduced into leſs ſpaces in proportion as the compreſſing powers increaſe. And this ſeems to be the reaſon why chyle and milk, which are always lighter than blood, are changed into ſolid and compact blood, being impreſſed by the repeated actions of the veſſels.

But all the new liquids that paſs into the body enter always by the veins, whether they are conveyed through the mouth in our meat and drink, or are drawn in by the abſorbent veſſels which are ſpread over the whole ſurface of the body; as the veins eaſily dilate and admit them all. But when they have paſſed from theſe into the arteries, if theſe arteries are ſtronger than is required to health, the introduced liquids are preſently carried off. For which reaſon we plainly ſee, why lean and ſtrong men oftentimes eat more than twice as much as fat and idle men, and though they have but few ſtools, do notwithſtanding not grow fat. The food they take indeed enters the lacteal veins, and is thence conveyed into the *vena cava* and the right ventricle of the heart, but is ſo attenuated in paſſing through the pulmonary arteries, and afterwards through the whole arterial ſyſtem, as to be preſently carried off by the perſpiring veſſels, and ſo vaniſhes into nothing.

And hereby to reſiſt their protruſion from the heart, *&c.*] It is to be carefully remarked, that though the power of the arteries be increaſed, yet they do not therefore preſently bring on a greater reſiſtance to the heart than is requiſite; for the ſtrength of the heart increaſes with that of the artery, as the influx of the venal blood into the cavities of the heart, the circulation of the arterial blood through its ſubſtance, the influx of the ſpirits into its muſcular villi, are the cauſes upon which its muſcular motion depends. But when the aorta contracts itſelf with greater force, it drives the blood more ſwiftly through the coronary arteries into the ſubſtance of the heart; whereby it applies the blood with more power to the cerebrum and cerebellum by the carotid and vertebral arteries; from whence follows a larger ſecretion of ſpirits; and conſequently it increaſes the velocity of the blood flowing from the arteries into the veins, and by this increaſed velocity occaſions a greater irritation of the heart. So that all the cauſes of the muſcular motion of the heart are increaſed by the increaſed ſtrength of the arteries.

Whilet his æquilibrium continues, the food is moſt perfectly and ſpeedily converted into our nature; a great degree of ſolidity is given to the blood, and as yet no detriment done to health. But when the ſtrength of the arteries increaſe ſo far as that they are ſcarcely to be dilated, then follow all the miſchiefs here related. For if the arteries be not firſt dilated, they cannot afterwards contract: but their contraction is the principal cauſe of the motion of the blood through the veſſels; for the action of the heart only dilates the arteries, and then throws into them the blood that was contained in its cavities; the next moment the arteries contracting propel it. This clearly appears when a large artery is wounded; for the blood never flows out in a continual ſtream, but *per ſaltum*, with much leſs ſwiftneſs while the heart contracting dilates the arteries, and with much greater when theſe contract and the heart is in its diaſtole.

When therefore from any cauſe whatſoever the veſſels are become ſo rigid, as not to admit of being dilated, or not ſufficiently, then the power of the heart cannot entirely expel the blood out of its cavities, and being irritated by a wonderful kind of teneſmus as it were, it labours to do that at ſeveral times which it cannot do by one contraction; hence proceed the frequent palpitations of the heart and interrupted pulſe, which are ſo obſervable in very old age; for in very long-lived people the great veſſels about the heart have ſometimes been found cartilaginous, and even bony, as the writers of medical obſervations can teſtify. Now when the motion of the heart is diſordered, every function of the body is diſordered too, as the heart is the ſource and origin of motion. For which reaſon no ſecretion or excretion continue to be performed as before; but when the blood begins to ſtagnate in the cavities of the heart, it generates a

Polypus, (ſo called from a fiſh named polypus) which fixes itſelf by ſeveral roots near to one another, and is a diſeaſe that is very frequent, obſcure, and obſtinate.

Malpighius, in his treatiſe of the polypus of the heart, was the firſt that gave light to this ſubject, which before was almoſt entirely in the dark, and ſhewed whence it was that theſe polypus's in the heart and large arteries aroſe.

For the blood of a ſound man drawn from a vein preſently grows thicker, and begins to form a concreted maſs, ſeparating from itſelf a yellow fluid. This maſs in time coagulates more and more, and ſwims in the liquid that is expreſſed out of it, and if waſhed in pure water will turn white, ſeem fibrous, and if cut through will appear to be a cellular ſubſtance filled with a reddiſh colour.

The experiment of Ruſych beforementioned (§. 39) ſhews us how ſuch a concretion, when once begun to be formed, will attract to itſelf ſimilar parts out of the blood, and from their union become a kind of membrane.

The blood therefore of an healthy perſon, as appears from the experiments of Malpighius and Ruyſch, conſiſts of two parts that repel each other, but which the vital motion mixes together: hence, as ſoon as the blood of the ſoundeſt man reſts but a little in the great veſſels, or being but little moved is aggregated too much in the diſtended veſſels, it is diſpoſed to a kind of flocculent coagulation. Theſe little fleeces run together, aſſimilate, and attract other parts like themſelves, and ſo form little polypous maſſes, which grow to an immenſe ſize by the ſame cauſe continued, and adhere to the veſſels themſelves, and to the *columnæ* and auricles of the heart, as appears from the obſervations made upon the inſpection of dead bodies (*a*).

In ſlaughtered animals, the whole quantity almoſt of the blood being ſhed, there remains only a ſmall portion about the right ventricle of the heart concreted into little oblong polypous maſſes: and hence the reaſon appears, why after the loſs of a great quantity of blood, polypus's are often formed about the great veſſels, and afterwards bring on the moſt miſerable diſeaſes. Thus I have ſeen a woman, who loſt ſo much blood by means of an abortion, that ſhe was laid out for dead; ſhe ſurvived it however, and was tolerably well whilſt ſhe ſat ſtill; but upon every the leaſt motion, there preſently followed an intolerable anxiety, a ſudden dejection of ſtrength, and moſt miſerable panting, 'till by lying or ſitting ſtill ſhe grew by degrees to be more calm and compoſed; and thus has ſhe been theſe ten years confined to her bed. In this woman the ſame effects ſeem to have been produced as in ſlaughtered animals, that is, ſome polypous concretions ſeem to have been formed in her, which admit the blood to paſs ſlowly through them, but upon a quick motion quite choak up its way.

This appears moſt clearly in ſuch as are liable to fall into a ſyncope; for theſe, when they come to themſelves ſigh and pant; becauſe the little polypous flocculi of concreted blood are ſtopped in the pulmonary artery, which from a vaſt capacity immediately becomes extremely narrow; in which ſtate they move forward and backward by the contraction of the heart and pulmonary artery, and the force of reſpiration, which is then always increaſed, and are ſometimes diſſolved; but ſuch as are frequently ſubject to this diſorder, upon

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(*a*) Abridgm. Tom. III. pag. 70. Malpigh. de Polypo, and frequently amongſt the writers of obſervations.

upon the formation of a polypus, are liable to palpitations of the heart all their lives after.

This diſeaſe would be moſt frequent in thoſe very active girls, that are apt to faint away upon every ſtrong paſſion, if their blood was not vitiated in an oppoſite kind to this polypous concretion; for in ſuch as have great ſtrength, and lead an active life, the blood is more Inclined to concretion, and therefore requires a perpetual and equable motion to prevent it.

From theſe polypous concretions, whether formed in the cavities of the heart or in its greater veſſels, ariſe ſuch irregular or terrible ſymptoms, that they have often been attributed to greater cauſes. Such a polypous concretion of the ſize of a pigeon's egg, without any adheſion, lying looſe in the left cavity of the heart, has produced a moſt dreadful diſorder (*b*).

There is but little hope of curing a confirmed polypus. There are many remedies cried up as effectual, but very ſeldom do good. All that can be hoped for is, to dilute the blood, and ſo throw it into a ſtate more remote from concretion; *i. e.* to introduce by art that cachochymy which conſiſts in the blood's being too thin, to the end the polypus may not be increaſed by the oppoſition of new matter, but by degrees be worn away by the conſtant attrition of the blood, which is every moment paſſing by it.

3. If our ſolids had no contractility, a wound would gape no wider than the thickneſs of the inſtrument that made it; but we ſee wounds made with the fineſt inſtrument gape almoſt immediately: for the force, wherewith the firm parts cohere, cauſes both the extremities to recede from each other. The greater therefore this force is, the more will the parts that are cut be drawn aſunder from each other. When therefore the veſſels are quite cut through, the ſame power will cauſe their extremities to retract, and hide themſelves under other parts; and thus in this caſe hæmorrhages will be ſooner ſtopped in ſtronger than in weaker

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(*b*) Act. Phyſic. Med. Vol. II. pag. 5.

weaker people, as the contractive power of the orbicular fibres is ſtronger in the arteries of robuſt people.

## SECT. LIII.

FROM theſe (31, 32, 33, 34, 35, 36, 37, 50, 51, 52) accurately underſtood, we may eaſily learn how to know the rigidity, elaſticity of the veſſels, and their effect, paſt, preſent, or to come, their preſent and approaching action, with their cure.

We have already in the foregoing chapters, §. 27 and 34, laid down the method of diſcovering the diagnoſis of a diſeaſe when preſent, the recollection of one paſt, the prognoſis of a future one and its effects, and laſtly the curative indication.

## SECT. LIV.

FOR this is wrought 1. by the remedies proper to cure the rigidity of a fibre (35). 2. Thoſe eſpecially, which diminiſh the quantity, the denſity, and preſſure of the vital liquid. 3. Which ſuſpend the muſcular motion. 4. Thoſe which moiſten, mitigate, ſoften, dilute, reſolve, and abſterge.

1. Theſe have been treated of already.

2. Thoſe which diminiſh the quantity of the vital liquid.] In curing a fibre too rigid the ſolids only were conſidered: but in curing the veſſels and viſcera that are too rigid, regard is to be had both to the ſolids and fluids. Among the cauſes of too rigid viſcera, §. 51, was reckoned the ſtrong action of the propelled vital liquid, binding the fibres together. By the vital liquid we mean whatever flows from the heart and

returns to it again. But the more of this liquid is taken away, whilſt life remains, the leſs is the action and attrition of the ſolids againſt their contained fluids, *i. e.* the force of the circulation is diminiſhed: for if the quantity of the vital liquids be diminiſhed, a leſs quantity muſt of courſe return to the heart. But the influx of the blood returned by the veins into the cavities of the heart is juſtly reckoned one of the cauſes from whence its motion proceeds, as has been obſerved (§. 28) and elſewhere: the muſcular contraction of the heart therefore muſt neceſſarily be hereby diminiſhed in its force and velocity. This is plainly to be learnt from bleeding, as it is oftentimes capable of ſo reſtraining the violence of life in acute diſtempers, as to cauſe an univerſal remiſſion and abatement; nay when continued even to fainting, it is capable of carrying off a fever at once: as was once ſaid to Galen by a man that ſaw him cure a fever in this manner (*a*), *O homo, jugulaſti febrim*; "Sir, you have murthered "the fever."

From the earlieſt ages it has been a diſpute among Phyſicians in what manner too great a quantity of the vital liquid ought to be leſſened. The moſt ſimple method, and moſt agreeable to nature, which ſo often cures diſeaſes by an hæmorrhage, ſeems to be by opening a vein; but the followers of Eraſiſtratus condemned all bleeding, and would have the too exorbitant quantity of blood diminiſhed by abſtinence, which they enjoined their patients to obſerve for three days together: this famous διατρίος ἀσιτία, or *three days abſtinence*, was condemned by Hippocrates in his treatiſe concerning the diet proper to be given in acute diſtempers. Galen wrote a whole book (*b*) in confutation of this opinion, and ſhewed it to be falſe both by reaſon and experience; though it has ſince been unhappily revived by ſome Chemiſts.

For

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(*a*) Method. Med. Lib. IX. cap. 4. Charter. Tom. X. pag. 206.

(*b*) De venæ ſectione adverſus Eraſiſtrat. Charter. Tom. X. pag. 406, *&c.*

For whilſt they thus attempt to leſſen the quantity of humours by abſtinence, the moſt ſubtle parts fly off; the thickeſt humours are the more condenſed in the larger veſſels, and all is diſpoſed towards a putrid acrimony. Whereas bleeding lets out the thickeſt part, that is, the red blood, and makes room for the uſe of diluents.

The denſity.] The blood of a healthy man always exceeds the denſity of water; and if it begin to degenerate into the thinneſs of water, his ſtrength decays, as we ſee in hydropical patients. When therefore the veſſels and viſcera abound too much in ſtrength, the veſſels being emptied by bleeding, and the more denſe part of the blood drawn out, it is adviſable to throw in a watery diet, ſuch as whey, barley-water, *&c.* in which water predominates; that the veſſels being filled with theſe may be weakened, and a tendency to a dropſy introduced. Hippocrates ſcarce allowed any other than a watery diet in acute diſtempers.

Preſſure.] All the aliments we eat or drink are lighter than the blood; it is by the continual action of the veſſels therefore that theſe are compacted and conſolidated into good blood. The leſs this power of the veſſels is, the leſs the blood is compacted; as we ſee in weakly girls, through whoſe veſſels there flows no ſolid blood, but a ſort of reddiſh ichor. The fuller the veſſels are, the more are the contained liquids compreſſed; for the force of the heart projecting the blood into the arteries, which are already very much diſtended, muſt compreſs the blood yet more to make them receive what was contained within its cavities. When therefore the fulneſs of the veſſels is abated, this cauſe alſo of the preſſure is leſſened. Now the more denſe our liquids are, with the greater impetus do they act on their veſſels; to which action the re-action of the veſſels on them is always equal in health. As the denſity of the liquids therefore is diminiſhed, their preſſure is of courſe diminiſhed.

minişhed too. Now the more ſwiftly the blood is propelled through the veſſels, ſo much the oftener in the ſame given time are the condenſing cauſes applied to our liquids. For which reaſon in all diſeaſes, where the power of life is too great, the wiſdom of antiquity enjoined the moſt abſolute reſt. The preſſure therefore is leſſened by diminiſhing the quantity, the denſity, and the motion of the fluids; and, which neceſſarily follows, the too great ſtrength of the veſſels preſent or future is taken away.

2. What the motion of the muſcles can do has been already obſerved, §. 28. numb. 2. §. 37, 43. numb. 3. §. 48.

4. Thoſe which moiſten.] Now what is it which in phyſic we term *to moiſten?* It is to fill the body with more liquids than it had before; and likewiſe to diſpoſe it to retain more than it formerly did. For if water be taken down, which ſtays not in the body, the body is waſhed all over with it indeed, but not moiſtened. Warm water drank alone relaxes all the veſſels, but it ſoftens and moiſtens much more if boiled with ſome farinaceous ſubſtance, and diſpoſes the veſſels to reſiſt repletion leſs. All this is true, as to the ſolids, but as to the fluids there is a difficulty ſtill remains; for the blood, through the too powerful action of the veſſels upon the fluids, will begin to aſſume an inflammatory ſpiſſitude, in which caſe it will not eaſily mix with the water introduced. Thus in very acute diſeaſes it is often ſeen, that a large quantity of water drank preſently paſſes off by urine and ſweat, and in a few hours time the urine ſhall become as red as before, and the ſymptoms not relieved. In this caſe the water ſeems to have flowed together with the blood through the veſſels, but not to have been admitted to any cloſe mixture or coheſion with it, and therefore to have been preſently ſeparated from it. And then the mildeſt ſaponaceous ſubſtances intermixed with water, of which kind are the juices of the ſummer-fruits, of the emollient herbs, honey,

manna, ſugar, &c. do ſo divide the blood, which is too apt to run into concretions, as to make its mixture with the water more eaſy and laſting.

The moiſtening medicines are deſcribed in the *materia medica*; in all of which water conſtantly predominates. There are likewiſe ſuch as add a kind of glutinous lentor to the water, which otherwiſe would paſs off too ſpeedily; theſe are of the farinaceous kind, and all the emollient herbs. To theſe are alſo added ſaponaceous ſubſtances, which divide the too great lentor of the blood: for this purpoſe crawfiſh ſoops are particularly commended in Greece, as they have been ever ſince the days of Hippocrates, for thoſe dry conſumptions called maraſmi. In Italy viper-broths are highly valued; and in the room of theſe, broths of eels may perhaps commodiouſly be ſubſtituted: for in all theſe ſubſtances the juices are mild, moiſtening, and inclining to be viſcous, which in ſuch ſapleſs ſubjects will do more ſervice than could even almoſt be expected. If an agreeable taſte be added to theſe decoctions, which of themſelves are inſipid, by the intermixture of ſome grateful herbs, they will conſtitute a noble remedy.

Which mitigate.] The medicines called lenient are ſo termed with regard either to the ſolids or the fluids: the former abate the too great rigidity of the ſolids: the latter blunt and inviſcate whatever is acrid and ſtimulating; of which kind are all thoſe that have been mentioned before.

Soften.] Emollients are of the ſame claſs with lenients, except that theſe relate to the ſolids only; lenients to both ſolids and fluids.

Dilute.] This term relates only to the liquids; and if theſe be diluted the ſolids are relaxed. But what is it that does dilute? Certainly water is the only proper diluent with reſpect to our blood; and all the reſt, which are called diluents, are only in the quality of water. Salts indeed reſolve and attenuate, but do not dilute. All ſpirituous liquids rather coagulate our humours. Very cold water likewiſe, as well as hot, coagulates the blood; warm water therefore is the beſt diluent. And this may be applied to the body by baths, vapours, clyſters, fomentations, *&c.*

Reſolve.] Too great ſtrength was obſerved to be the effect of many veſſels being grown together, which before were pervious. With reſpect to the ſolids therefore, reſolvents ſhould be of ſuch a nature, as to be capable of opening the veſſels that before were grown together; but this ſeems to be ſcarce poſſible; at leaſt not very eaſy. But reſolvents with reſpect to the fluids are all thoſe medicines, which are capable of reſolving the formerly fluid parts, that are now concreted into ſuch particles as they conſiſted of before the concretion was formed. Theſe they do, either by inſinuating their own particles between the cohering particles of the concreted maſs, or like ſtimulatives by increaſing the force of the veſſels, ſo as to procure a greater attrition, and oftentimes a diviſion of the concreted ſubſtance; and ſometimes by both theſe qualities united.

The red blood in the courſe of its circulation muſt paſs through veſſels, whoſe diameter does not exceed the tenth part of the thickneſs of an hair: but when drawn out of the body forms itſelf into ſuch concretions, that it cannot paſs through the largeſt canals: that now would moſt fully deſerve the name of a reſolvent, which could divide again the concreted blood into ſuch ſmall particles, as that it might paſs through the ſmalleſt veſſels, as it did before.

As there are different kinds of concreting humours, ſo there are required different ſorts of reſolvents: the principal of which are enumerated in the *materia medica* under this number.

For the watery diluents reſolve all mucous, glutinous, gummy, ſoapy, concretions, and yet many others are not to be reſolved by water; for blood is not to be kept from coagulating by being put into warm water.

Many of the ſaline reſolvents enumerated in the *materia medica* do very well diſcharge this office. The neutral ſalts are mighty well adapted for reſolving inflammatory concretions; eſpecially nitre and many of its preparations, which being lighter than ſea-ſalt, and more eaſily to be combated with by our nature, is given to ſuch good purpoſe in almoſt all acute diſeaſes. The alcaline ſalts are commended chiefly for reſolving glutinous viſcid concretions, *&c.*

Saponaceous ſubſtances, eſpecially ſuch very mild ones, as ſugar, honey, the juices, *&c.* are of great ſervice in reſolving many concretions, without raiſing any commotions in the body; whereas the ſtronger ſorts, and eſpecially the acrid and chemical, act by raiſing a violent motion.

Yet all theſe are very much aſſiſted by frictions, whilſt by an alternate preſſure and relaxation the reſolvents, intermixed with the blood, are as it were triturated with the concreted fluid. Thus certainly moderate friction, after expoſing the part to a warm vapour, joined to the uſe of the moſt diſſolving remedies given inwardly, has often diſperſed ſuch hard tumours of the glands, as ſeemed ſcarce poſſible to be reſolved.

Abſterge.] When any thing viſcous or glutinous is ſo tenacious as to ſtick to a veſſel, and obſtruct the natural paſſages, if this viſcoſity be removed, that part of the body is ſaid to be deterged. For this reaſon all abſtergents are reſolvents of concretions, eſpecially thoſe of the ſaponaceous kind. Such viſcoſity adhering to the veſſels is ſeldom found in the veſſels through which the motion of the humours is very ſwift; but in the ſmalleſt veſſels, or receptacles where humours are collected for their proper uſe, they ſometimes occur. And yet it would be a great miſtake to reckon all ſuch viſcoſity morbid; for certainly the whole inſide of the mouth, gullet, ſtomach, *&c.* are lined with ſuch a mucus, which, if it failed, would give riſe to very bad diſeaſes. To this claſs of abſtergents belongs whatever dilutes, and whatever reſolves, and moſt particularly whatever is ſaponaceous. And theſe are ſerviceable in curing the rigidity of the veſſels and viſcera, as they remove obſtacles, and make the paſſage through the veſſels perfectly free, by which means the circulation being made entirely uniform, is not ſo apt to bind the ſolid parts ſo cloſe together, or condenſe the fluids with ſo much force.

## SECT. LV.

FROM all theſe (*viz.* from 21 to 55) the diſeaſes proper to the ſolid parts are capable of being underſtood and cured: and the ſame principles alſo will furniſh us with an anſwer to the following queſtions: What difference there is in the ſtructure of the ſolid parts in the different times of life? Why a man grows, continues in the ſame ſtate, becomes ſhorter and leſs? Why in the womb there is the ſwifteſt growth of all? Whence he becomes lax, ſtrong, rigid? Whence moiſt, full, dry? Whence he dies naturally by old age, and then of what diſeaſe? What diſeaſes are for the moſt part peculiar to every age? What ſort of diet, life, and medicines, are ſuitable to the ſeveral ſeaſons of life? What truth there is in the doctrine of aſtriction and laxity in the ſolids, and what its uſe? Whence the moſt certain ſigns of the juſt degree of laxity and aſtriction in a man are to be drawn?

From what has been hitherto delivered, all the diſeaſes of the ſolid parts are capable of being underſtood, as they muſt all ariſe from ſome diſorder in their coheſion; from which doctrine many of the moſt uſeful deductions in phyſick may be drawn, and particularly an eaſy anſwer be given to the following queſtions.

What difference there is in the ſtructure, *&c.*] The nearer the human body is to its original, the more veſſels, ſimple fibres, and membranes, does it conſiſt of, the more eaſily do the veſſels yield to the impulſe of the liquids contained in them, and the greater is the proportion of the brain and nerves to the other parts. Examine the body of an infant juſt brought into the world, and you will find every part of it to be pulpy, ſoft, and moiſt; the hollows of the hands and ſoles of the feet are in every point bedewed with a gentle moiſture, exhaling from the very ſmall perſpiring veſſels; nothing is dry, nothing is callous; as the child grows older, numbers of the ſmalleſt veſſels begin to be conſolidated: thus their number leſſens, and the ſtrength of the ſolids increaſes; 'till at length, in extreme old age, the ſapleſs trunk grows hard and callous, and numbers of the ſmalleſt veſſels are loſt; for which reaſon all the actions, that depend on the motion of the moſt ſubtle humour through the leaſt veſſels, begin to fail in old men; and the ſolids being grown too rigid, ſtrongly reſiſt the impulſe of the fluids.

Why a man grows?] Hippocrates had obſerved (*a*), *Partes autem ſimul omnes diſcernuntur, & augentur, neque una prior altera neque poſterior; majores tamen natura minoribus priores conſpiciuntur, quam priores non exiſtant*; "That all the parts are framed and grow " together, nor is one part ſooner or later than an" other; only the greater parts are ſeen before the " ſmaller, but did not exiſt before them." And indeed when we conſider the wonderful hiſtory of animal generation, ſo far as it is now known, from the moſt faithful obſervations, it ſeems only the unfolding of the parts that were pre-exiſtent in the embryo. This is certain of plants, that the entire plant lies convolved in a fruitful ſeed, which is afterwards by degrees to be unfolded. Whilſt therefore the greateſt part

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(*a*) De victûs ratione ſanorum, Lib. I. cap. 2. Charter. Tom. VI. pag. 455.

part of the veſſels thus lie twiſted together and convolved in the tender embryo, there muſt be a reſiſtance to the motion of the liquids that are to be carried through them: but the conſequence of liquids flowing through canals that reſiſt them, will be the diſtenſion of them, and the ſtretching out of their ſides in length: hence follows elongation and increaſe. But when the veſſels are all unfolded, and the reſiſtance to the motion of the liquids becomes leſs, then is the circulation moſt free through all the canals; then they are no more drawn out into length, as the liquids have now a free courſe through them; and the ſides of the canals being grown ſolid by the vital motion, do not admit of being diſtended farther by the ſame force: in which caſe the body

Continues in the ſame ſtate;] That is, whilſt the quantity and force of the liquids impelled by the heart are in an æquilibrium with the reſiſting powers of the ſolids. For the body ceaſes not to grow, becauſe the ſolids cannot be extended any farther, but becauſe the veſſels being all unfolded, the circulation is free, and prevents the liquids from preſſing too forcibly againſt the canals. For if an obſtruction happens in certain veſſels from any cauſe whatſoever, even in an adult perſon, we find that the parts increaſe, though the velocity and quantity of the humours continue the ſame. This we ſee in a pregnant womb, which is capable of being expanded to ſo large a bulk; in the liver and ſpleen, which in caſe of obſtructions grow to ſuch a monſtrous ſize; and ſo the inviſibly ſmall cutaneous veſſels are greatly increaſed by the compreſſure of a neighbouring atheroma (*b*).

And poſſibly the wonderful increaſe diſcernible in ſome particular parts may owe its riſe to ſome ſuch latent cauſe. Thus have I known a girl, whoſe tongue has grown to ſo vaſt a bulk as to hang out of her mouth below her chin, and yet her deglutition, ſpeech, and taſte, were preſerved entire.

Decreaſes.]

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(*b*) Simſon's ſyſtem of the womb, pag. 24, 25, *&c.*

Decreaſes.] The veſſels become ſo ſtrong by the unavoidable effect of life, as in courſe of time to reſiſt the motion of the fluids too much. From whence, by degrees, a general concoction enſues; the whole body becomes dry and ſapleſs; the fat, which conſtitutes ſo large a part of the bulk of the human body, is almoſt wholly conſumed; ſo that in the hands of old men we ſee the ſtrings of the tendons left bare, without ſcarce any fat at all, that can be ſeen; thoſe ſurpriſing ligaments, which lie between the ſeveral vertebræ, become ſo indiſcernible, that the vertebræ touch one another; by which means the ſtature is diminiſhed, the ſpine of the back bends forward, and as age comes on we grow round ſhouldered and ſtooping, 'till at laſt we conſume away and die.

Why in the womb, *&c.*] That this is fact we are abſolutely certain; for in nine months time the infant grows from an inviſible ſpeck to the weight oftentimes of ſixteen pounds, and ſometimes more. The reaſon ſeems to be, that the veſſels are very tender, that lie near the little heart which beats ſtrongly, and being for the moſt part convolved, make the more reſiſtance to the impelled fluids, by which means they are the more lengthened and diſtended: the whole embryo is continually fomented with the warm liquor of the amnion, and thereby kept perfectly lax in all its parts; and the nouriſhment prepared in the body of the mother is continually thrown into it, and very equally diſtributed.

Whence lax.] If a man indulges himſelf in idleneſs and ſloth, if he ſleeps much, and at the ſame time feeds upon ſoft kinds of food, his body will grow big and unweildy, but his ſtrength will not be increaſed, nor his veſſels be conſolidated, and conſequently will eaſily give way, and be diſtended by the liquids wherewith they are filled.

Strong.] So long as the liquids are ſuperior to the firmneſs of the ſolids, the body ſwells and is lax: but when the veſſels are ſo far ſtrengthened by exerciſe as to be able to ſuſtain the force of the liquid without too great a dilatation, a man is ſaid to be ſtrong; as in this caſe there is a firm coheſion of the ſolid parts, and a due denſity of the humours.

Rigid.] The ſame cauſes continued that made the body ſtrong, will at laſt make it rigid. Age, by degrees ſtrengthens the body of an infant; exerciſe gives ſtrength even to the weakeſt: a more advanced age induces an univerſal rigidity and calloſity; too much labour brings on an untimely old age.

Whence humid.] All our veins eaſily dilate and fill with new liquids; which the firmer ſtrength of the arteries again expels. A ſtrong healthy man may drink an incredible quantity of water, which the veins will receive, and deliver to the heart, and then being diſtributed into the arteries it will be expelled out of the body; for the next day he returns to his old weight. But when the arteries are ſo weak as not to move their humours ſufficiently, or not to expel what is ſuperfluous, the liquids are accumulated and prevail over the ſolids, and introduce what is called a moiſt temperament.

Full.] A man is ſaid to be full when his veſſels are fuller of good humours than is requiſite to an eſtabliſhed ſtate of health. In theſe men the veſſels are ſo lax as to admit of being filled to a degree juſt ſhort of a diſeaſe; ſhould the humours therefore be increaſed, or rarefied by heat, or any other cauſe, they can no longer continue in a ſtate of health.

Dry.] This is meerly from the increaſing ſtrength of the veſſels. When the arteries contract with more force than is required to perfect health, the liquids are expelled, and the body grows dry: hence age and labour render the body dry by ſtrengthening it.

Why a man dies a natural death, *&c.*] That is called a natural death, which follows from the conſtitution of the body by the unavoidable law of its formation: this happens from the elementary particles of the fibres uniting to each other, as alſo fibres with fibres, membranes with membranes, and the flattened veſſels with each other; 'till at length the ſmalleſt veſſels being almoſt all grown together, the circulation is performed in the greater veſſels only: and theſe at laſt growing callous, and even cartilaginous and bony, (as has been found true by undeniable obſervation) hinder the free expulſion of the blood from the heart: and thus life ends in a gentle and moſt deſirable death. Thus died Lewis Cornaro, after he had lived upwards of an hundred years (*c*).

Hence appears how vain the boaſting of the Chemiſts was, whoſe promiſes fell very little ſhort of immortality; at leaſt they gave out that they could prolong life to what limits they pleaſed. See §. 39. numb. 1.

And of what diſeaſe then.] By meer ceſſation of motion in the heart, when filled and unable to empty itſelf into the arteries, whilſt full, and too rigid to be diſtended by the power of the heart.

What diſeaſes, *&c.*] The conſideration of this matter is both entertaining and neceſſary, as a man is liable to different diſeaſes at different ages.

In the earlieſt part of life a man is moſt liable to all the diſeaſes of the nervous kind; becauſe, as we learn from obſervation, the brain and its productions, *i. e.* the *medulla ſpinalis* and the nerves, are larger in proportion to the reſt of the body, the nearer a man is to his original. Add to this, that as the brain is leſs firm at that age, the nerves, which are produced from the brain, are ſofter and more eaſily affected, beſides that, the integuments are thinner; hence it is, that children are ſo apt to fall into convulſions; for a child can ſcarce have the ſlighteſt fever, but it is attended with a convulſion: pains of the belly from acidities, the infection of the ſmall-pox or meaſles, whatever makes a ſtrong impreſſion upon the ſenſes, a great noiſe, a glaring light, *&c.* will often throw children

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(*c*) Raadgeving om geſond en lang te leven, pag. 78.

children into convulſions; inſomuch that Sydenham (*d*), whenever he obſerved children after dentition to fall into convulſions, was accuſtomed to prognoſticate the coming on of the ſmall-pox, and generally of a diſtinct ſort. And for the ſame reaſon, Hippocrates obſerving from what ſlight cauſes convulſions would ariſe in this early time of life, made no ſcruple to declare them not ſo hazardous before a child came to be ſeven years old, as they were afterwards, ſince then they could not be occaſioned but by cauſes of greater conſequence.

Another ſource of diſeaſes in this tender age, is the quantity of humours being more than proportioned to the powers of the ſolids. In our infancy we are all diſpoſed to be turgid and moiſt. And from hence ariſe thoſe eaſy and wonderful changes of the cutaneous humours, which ſo frequently ſhew themſelves in a manner as yet not well underſtood. This appears in the ulcers of the head, the herpes, the excoriations behind the ears, the arm-pits, *&c.* by which an incredible quantity of humour is diſcharged daily, and which if imprudently ſtopped gives riſe oftentimes to the moſt troubleſome diſeaſes.

Afterward, about the time of puberty, the whole body ſuffers wonderful changes in both ſexes; in the male tumours of the teſticles, various inflations of ſeminal veſſels, which are eaſily cured by gentle friction whilſt expoſed to the vapour of lighted amber, and at the ſame time giving a gentle purge: in the female, ſurpriſing diſeaſes do often both precede and attend the firſt eruption of the menſtruous flux.

When after this the body begins to reſiſt any farther increaſe, and the veſſels do not ſo eaſily ſuffer themſelves to be extended, the force and quantity of the fluids are ballanced by the reſiſtance of the veſſels. In the mean time the ſound viſcera go on to generate new humours daily, and hence follow ruptures of the veſſels, bleeding of the noſe, ſpitting of blood, *&c.*

When

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(*d*) Page 132.

(*e*) In Prognoſticis et Coacis.

When a man is full grown, the action of the veſſels on the fluids is very great, by which means the blood is rendered denſe and compact; for which reaſon acute and inflammatory diſeaſes, at this time moſt frequently prevail.

As age comes on, the ſolids become more compact, the ſmalleſt veſſels, by degrees, grow together and become callous; whatever depended on the motion of the moſt ſubtle humours through the ſmalleſt veſſels, begins gradually to fail, the ſeveral functions of the brain and nerves begin to grow weaker, the humours degenerate into a cold and pituitous diſpoſition, the circulation is performed only in the larger veſſels, and at length death enſues by inevitable neceſſity. *Quia naturæ progreſſum, quia eſt ad ſiccitatem, effugere non licet, ideo ſeneſcimus & corrumpimur*, ſays Galen (f); "We "therefore grow old and decay, becauſe we cannot "ſtop the progreſs of nature, which tends to dryneſs."

Hippocrates was very careful in obſerving the various diſeaſes incident to each particular age (*g*).

What diet.] While the child is in the womb, it lives upon the humours prepared by the mother. When it is born, it preſently finds the way to its mother's breaſts. Scarce any thing therefore but the mother's milk agrees well with infants. When the fore-teeth appear, more ſolid food, firſt reduced to a pulp is to be given; their bodies alſo ſhould be often rubbed upon an empty ſtomach (*h*). Bread well fermented, made into a pap with milk or ſmall broth, is then alſo very proper for them. When the jaw-teeth appear, they ſhould by degrees be accuſtomed to harder food: but whatever is hot, vinous, and irritating, muſt be prejudicial to infants, as they are ſo ſubject to nervous indiſpoſitions.

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(*f*) Galen, de ſanitate tuenda, Lib. VI. cap. 3. Charter. Tom. VI. pag. 169.

(*g*) Sect. 3. Aphoriſm. 24, 25, 26, 27, 28, 29, 30, 31.

(*h*) Galen, de ſanitate tuenda, Lib. I. cap. 10. Charter. Tom. VI. pag. 55.

Children ſhould be fed often, as their ſtrong appetite requires; and Hippocrates acquaints us, that boys can very ill bear faſting (*i*). Such as are growing have great innate heat, and for this reaſon ſtand in need of a large ſupply of aliment, or otherwiſe the body will be conſumed.

For ſuch as are full grown and well, the rule of Hippocrates is almoſt ſufficient (*k*); *Valetudinem excolunt, citra ſatietatem cibis veſci, & impigrum eſſe ad labores*; "that they who would take care of their "health, ſhould riſe from table with an appetite, and "not be ſlothful to labour." And becauſe this age is liable to the moſt acute diſeaſes, it is plain that whatever is apt to overheat ſhould carefully be avoided. But let the diet be always proportioned to the exerciſe: for the man who labours hard at the plough, requires a quite different ſort of food, and a greater quantity than the philoſopher, who applies himſelf ſolely to meditation and ſtudy.

As to old men (*cum & facillimè jejunium ferant, & parvum habeant calorem, hinc paucis egent fomitibus à copioſis namque extinguuntur (l)*; "as they bear faſting "eaſily, and have but little heat, and therefore need "but little aliment, and would be deſtroyed with a "great deal,") it is beſt to give them a ſoft kind of food very frequently; for as they are grown toothleſs, and become children a ſecond time, they ſhould live almoſt entirely upon milk, broth, and eggs, with a moderate uſe of wine, which is more eſpecially beneficial to them, and is therefore called the milk of old men. In fermenting liquids there is produced a wonderful ſpirituous part that acts on the brain, and all the nerves inſtantly, and very powerfully; but if imprudently taken in too great a quantity, kills, and that very ſuddenly; or if it acts with leſs violence, ſhall

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(*i*) Aphor. 13. & 14. Sect. 1. Charter. Tom. IX. pag. 23, 24.

(*k*) Epidem. Lib. VI. Charter. Tom. IX. pag. 500.

(*l*) Hippocr. Aphor. 13 & 14. Sect. 1. Charter. Tom. IX. pag. 23, 24.

ſhall ſometimes bring on a ſtate worſe than death, ſuch as madneſs and other diſorders (*m*). This ſpirituous part reſiding in the briſker ſorts of wine when new, is the greateſt reſtorative that can be given in old age. Cornaro abſolutely abſtained from wine during the months of July and Auguſt every year; in conſequence of which his appetite failed him, and by the middle of Auguſt he was become perfectly weak: but as ſoon as he had drank new wine for three or four days in the beginning of September, his ſtrength preſently returned, and the vigour of a lively old age (*n*).

What ſort of life.] In their tender age when the body is almoſt always in motion, children can hardly be kept ſtill, and bear it very ill if they are kept from play by their too ſevere parents or maſters. On the other hand, if they are put to hard labour too ſoon, their conſtitution will become robuſt indeed by this means, but will decay before its time through a ſenile calloſity. Thus we ſee country-people, who have been inured to too hard labour from their infancy, become ſtiff and callous like old men by that time they are forty years old.

It is no leſs faulty to put them too early upon an application to ſeverer ſtudies: by this means indeed they will often give ſurpriſing inſtances of genius very early; but then they commonly drop ſoon, or live ſtupid or unfit for any employment. Inſtances of this kind frequently occur.

As to adult perſons, it is moſt adviſable for them to keep up and ſupport their ſtrength by healthful exerciſe; that the body grow not torpid, nor the man lie buried in his own fat (as Juſtin ſays of Ptolemy king of Egypt) (*o*) 'till he thereby loſes his ſenſes. Of what uſe exerciſe is to the human body, has been already explained, §. 28. numb. 2.

Galen

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(*m*) H. B. Chem. Tom. I. pag. 806, 807.

(*n*) Cornaro raadeving om geſond en lang te konnen leben, pag. 54, 55.

(*o*) Lib. XXXIV. cap. 2.

Galen recommends to all old men the uſe of friction with oil in a morning after ſleep (*p*), and directs them to continue their accuſtomed labours, but with leſs vehemence: and becauſe old men are ſenſible of the leaſt error in diet, and young men ſcarcely of the greateſt, he directs them to the frequent uſe of emollient food (*q*).

What medicine.] Such medicines ſeem only proper for children, as in ſome degree diminiſh the quantity of humours: and for this reaſon it is, that the mildeſt purges agree ſo well with them, and particularly rhubarb. Such medicines alſo in general are ſerviceable to them, as have a tendency to correct whatever is acid or acrimonious, ſuch as the abſorbent powders of crabs-eyes, *&c.* in like manner whatever may contribute to allay the too eaſy irritability of the nerves, and at the ſame time moderately ſtrengthen the ſolid parts. For which reaſon it is, that rhubarb, mixed with crabs-eyes and a little cinnamon, proves ſo beneficial to them.

As they grow in years, be careful not to give ſuch medicines, as by ſtimulating too much may incite too violent a motion in the humours, leſt the tender veſſels be thereby broken.

At full growth ſuch medicines are more particularly advantageous, as remove the too great propenſity of the humours to an inflammatory ſpiſſitude.

But old age, *cum ſi nihil aliud, quàm ſiccum & frigidum cnrporis temporamentum, annorum multitudine proveniens (r)*, "as it is only a dry and cold temperament "of body proceeding from a great number of years," requires ſuch applications, as moiſten and are lightly nouriſhing, with the addition of an agreeable ſtimulus; but then never without ſomewhat moiſtening intermixed with them.

What

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(*p*) De ſanitate tuenda, Lib. V. cap. 3. Charter. Tom. VI. pag. 144.

(*q*) Ibid. cap. 4. Charter. Tom. VI. pag. 146.

(*r*) Ibid. cap. 9. Charter. Tom. VI. pag. 154.

What the truth and uſe, &c.] When medicine was divided into two ſects, which had each their followers, ſome maintained that the art was founded ſolely on experiments; they admitted manifeſt cauſes to be neceſſary, but maintained that all enquiry about obſcure cauſes and natural actions was needleſs; and ſaid, that the invention of phyſick was not preceded by reaſoning, but that reaſoning was introduced after the art had been diſcovered; and hence they maintained, that the knowledge of experiments only was neceſſary; theſe were called empyricks. The rationaliſts, on the other hand, did not deny, that experiments alſo were neceſſary; but they added, that the knowledge of theſe could not be obtained in due manner, unleſs by the uſe of reaſon; they farther aſſerted, that it was neceſſary to know the ſeveral cauſes which gave riſe to diſeaſes, and after this to proceed to the knowledge of ſuch as were more manifeſt, and in conſequence of this they taught, that the knowledge of natural actions, and the internal ſtructure of the parts, was alſo requiſite.

Themiſon however, one of the rational Phyſicians, and a follower of Aſclepiades, drew up a compendium of this difficult art, wherein he maintained, as did ſome others after him, that the knowledge of the cauſe had nothing to do with the cure, and that it was enough to have in view ſome of the common properties of diſeaſes: whereof he conſtituted three ſeveral kinds, one from aſtriction, one from laxity, and a third mixed; for that the excretions of the ſick were ſometimes too little, ſometimes too much, and ſometimes too little in one part, and too much in another (*f*).

This was the firſt orign of the doctrine of aſtriction and laxity, whereof Proſper Alpinus has ſince treated ſo largely in his *Medicina Methodica*; and whereof ſo much is to be found in Cælius Aurelianus, who was

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(*f*) Vide Celſi præfat. Lib. I.

was likewiſe himſelf a follower of the ſect of the methodiſts.

But properly ſpeaking laxity and aſtriction take place only in the ſolid parts; nor can the diſeaſes of the humours be well explained thereby, as will hereafter appear. To conſider the difference of coheſion therefore in the ſolids is a matter of great moment in phyſick; yet all diſeaſes cannot be derived from thence, as the methodiſts pretended.

Whence the moſt certain ſigns are to be taken, *&c.*] It is proper here to enquire what are the ſigns, by which we may know, that there is ſuch a coheſion in the ſolids, as ſhall neither reſiſt nor yield too much to the diſtending liquids? When the body does not preſently ſwell, or continue tumid long, after a fuller meal, a larger quantity of drink, or a moiſt air, we know that the veſſels and viſcera have their due ſtrength, by which the too great quantity of liquids is preſently diſcharged out of the body. In like manner, if the body of a perſon grown up does not leſſen, by the veſſels contracting too ſtrongly and ſo expelling their liquids, but continues in the ſame degree of fulneſs or is but little increaſed, we know that a due æquilibrium is preſerved. Should the body after a large meal preſently ſwell, we know that the veſſels are too weak and dilate too eaſily: if it grows too lean, ſapleſs, and dry, we eaſily ſee that the veſſels are too ſtrong.

## SECT. LVI.

WE ought now (16), after the moſt ſimple diſeaſes of the ſolids, to treat of wounds; but as theſe always bring with them the ſpontaneous diſorders of the liquids, theſe muſt be firſt treated of, as requiſite to be known, in order to compleat the hiſtory of wounds.

Having explained the diſeaſes which depend on the too great ſtrength or weakneſs of the ſolids, we ſhould treat next of the non-coheſion, or of the diſſolution of their unity, as it is phraſed: the moſt ſimple diſeaſe of which kind is a wound, or a ſolution of the parts juſt made by the motion of a hard ſharp body. But it is well known, that be the wound ever ſo ſmall, there muſt be an effuſion of humours from the veſſels; that the humours thus extravaſated will ſtagnate, and not obey the laws of the body, but aſſume, by ſpontaneous corruption, a very different diſpoſition. Before therefore we can treat of wounds with advantage, we muſt explain what happens to the extravaſated humours.

## SECT. LVIII.

SO that we ſhall firſt of all treat of thoſe diſeaſes of the humours, which ariſe in them ſpontaneouſly, when left to themſelves, without any conſideration of the veſſels, or of the vital motion being either raiſed too high, or grown too torpid.

It is firſt then to be conſidered what changes occur in the liquids from the common cauſes, which act upon all bodies in general. Theſe changes we call ſpontaneous. Whilſt the liquids reſide in the veſſels, they ſuffer the action of the body and are changed by it. A ſpontaneous change alone can never take place in them, whilſt the powers of the veſſels and viſcera are conſtantly producing in them a very different change. Thus human milk, when drawn out of the body, will turn to whey, cheeſe, and a fat cream, which it never does whilſt in the body.

But the vital motion of the humours through the veſſels cauſes great changes in them, nay induces a quite oppoſite quality, according as that motion is raiſed too high and rages furiouſly as in acute diſeaſes, or languiſhes and is ſtill as it were, as in chronical diſtempers, which oppoſite effects are therefore neceſſary to be examined.

There are three things therefore here to be conſidered, 1. What happens to the humours, when out of their veſſels, from the common cauſes; 2. what changes ariſe in them from an increaſe of their motion; 3. what conſequences follow from the defects of it.

# Of the moſt ſimple and ſpontaneous DISORDERS of the HUMOURS.

## SECT. LVIII.

THE humours found in a living man, are either ſuch as are crude, or retain the nature of the aliment, or ſuch as, by the power of the natural functions, and the mixture of human fluids, have acquired a like nature with them.

All the humours flowing through our veſſels, either ſtill retain the nature of the food we take down, or by an intermixture of human liquids, and the motion of the veſſels and viſcera, laying aſide their own particular diſpoſition, they are converted into our nature.

Now, ſo long as the food we take down retains any thing of its own nature, it is called crude. It is crude meat and drink therefore which is ſwallowed. The chyle is crude in the ſtomach and inteſtines, in the lacteal veſſels, in the *ciſterna lumbaris*, the chyliferous duct, the great vein, the right ventricle of the heart, it is ſtill crude, though it has been already mixed with ſo many concocted humours. Whilſt it is paſſing through the lungs the ſecond concoction begins, which of chyle forms milk: 'till at length the crude chyle, having for ſome hours ſuſtained the action of the veſſels and viſcera, eſpecially of the lungs, loſes the nature of food, and is aſſimilated to our humours, and the concoction finiſhed.

And ſince this concoction requires a pretty long ſtay in the body, there is almoſt always ſomething crude, or not perfectly changed, flowing through the veſſels with the concocted humours, unleſs a perſon has abſtained from food for a conſiderable time.

## SECT. LIX.

THE firſt mentioned (58) are taken from plants, or other animals.

For our nutriment is taken both from the animal and the vegetable kingdoms; from the foſſile we take nothing but ſome ſort of ſeaſoning, ſuch as ſea-ſalt, ſal-gem, *&c.* unleſs water be alſo reckoned among the foſſils.

## Spontaneous DISEASES from an acid HUMOUR.

## SECT. LX.

IF the liquids in us compoſed either of the mealy plants, or the ſummer fruits, whether raw or fermented, overcome our vital powers, they will then acquire the ſame nature within us as they would have done if they had been left to themſelves in the ſame degree of heat. Of which the moſt common changes are an acid acrimony and glutinous fat. The former from ſuch materials as are both fermented and unfermented, but more eſpecially ſuch as are fermented: the latter from mealy grain or pulſe not fermented or boiled; and under this head may be brought ſuch auſtere ſubſtances as create a tenacity in the humours by their aſtringency.

An acid is that, which, when applied to the tongue, excites that peculiar taſte, which by common conſent is called ſour (for a taſte cannot be deſcribed); which if held under the noſtrils, eſpecially if heated firſt, produces that ſmell, which all men call ſour. All acids mixed with teſtaceous powders, the burnt bones of animals, chalk, *&c.* as alſo with all alcaline ſalts, occaſion an effervеſcence. Syrup of violets turns red if mixed with even the mildeſt acids.

Whatever therefore has the qualities above-recited we call acid.

It is at preſent much debated, whether ſuch an acid be owing to the aliments only, and the power of the body changes it into what is not acid; or whether ſuch an acid can naturally exiſt in the ſound liquids of a man or other animals, ſo that it may be extracted from thence by art?

Excepting milk, (and perhaps ſome fat ſubſtances) which has not yet entirely acquired an animal nature, and in which the nature of the aliment ſtill prevails, all the other humours left to themſelves in the open air will putrify. All animals left to themſelves will putrify, unleſs they be dried by a great heat. By a chemical analyſis we can extract volatile alcaline ſalts from them; but many even among the moſt celebrated Chemiſts deny that an acid can be drawn from them. The blood of an healthy man iſſuing from the vein has no ſign of any acid in it; ſound urine, which waſhes away the ſalts of the blood, has no ſuch ſign even in thoſe who have taken down a large quantity of acids. And yet has the contrary opinion been maintained by ſome very eminent men, who have ſupported their opinion with ſpecious arguments drawn both from reaſon and experiments.

For though the aliment be changed in the body before it nouriſhes, it may perhaps not always lay aſide all its qualities. The fleſh of birds, that live on fiſhes only, retain the diſagreeable fiſhy taſte; and the fleſh of black-birds, that feed on buckthorn-berries, is purgative. So that as we eat every day ſuch a quantity of food as is either actually acid or ſo diſpoſed to be, it ſeems probable that theſe may ſtill retain ſomething of their former quality.

Homberg affirms, that he obtained an acid by diſtillation from the blood of many animals, and even from human blood itſelf, and, which ſeems wonderful, that he extracted a liquor from it, which contained both an acid and an alcali ſeparately exiſting, and not concreted into a natural ſalt (*a*).

The ſame Homberg by diſtillation drew an acid from vipers, ſnails, flies, ants; and the phoſphorus of urine contains a very ſharp acid (*b*).

This was next confirmed by Lemery (*c*): who was even of opinion, that an acid ſtill adhered to the volatile ſalts of animals after they were drawn off by diſtillation (*d*).

He aſſerts, that an acid may be eaſily obtained from the parts of animals, if they be firſt macerated, ſo as to let the greateſt part of their volatile ſalt fly off; if a fixed alcaline ſalt be added to attract the acids, and prevent them from riſing with the volatile ſalt; if in the beginning a moderate fire be uſed, that the moſt volatile parts be made to aſcend firſt; and if afterward they be expoſed to a ſtrong fire, to drive out the acid which adheres to the earthy part (*e*).

The ſalts of human liquids, before they are changed by art, approach neareſt to the nature of ſal ammoniac;

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(*a*) Academ. des ſciences 1712. Mem. pag. 10 to 19.

(*b*) Academ. des ſciences 1712. Mem. 352 to 362.

(*c*) Academ. des ſciences 1719. pag. 227—246.

(*d*) Ibid. 1720. 218, &c.

(*e*) Ibid. 1720. Mem. 51, 52.

niac; and ſal ammoniac ſeems to conſiſt of a fixing acid and volatile alcaline ſalt united together: ſo that poſſibly ſomething like this may be the caſe in the human ſalts; it would therefore be no wonder, that when the volatile ſalt was expelled, there ſhould be an acid left in the reſiduum, which before was united with the volatile ſalt.

But theſe ſalts are produced in the body by the operation of the veſſels and viſcera. Have therefore theſe two conſtituent principles ever exiſted ſeparately in our humours, and been united afterwards? Or are the acids, which we take down in our food, ſo changed by the power of the body, as entirely to loſe their own nature? Or do they, without loſing their own nature, unite with a volatile alcali into a kind of ſal-ammoniac? The blood and urine, however, of an healthy man ſhew no ſign of an acid inherent in them.

This at leaſt is abſolutely certain, that many vegetable ſubſtances, and eſpecially of the mealy kind, the ſeveral ſorts of grain and pulſe, as likewiſe all the ſummer fruits, will either acquire an acid acrimony, or be changed into a glutinous fat, if expoſed to the ſame degree of heat, as is found in the body; that the ſame eaten by a ſtrong healthy perſon are ſo changed by the powers of the veſſels and viſcera, and the mixture of the human liquids, as to loſe their own nature and be converted into ours: but when by any accident the body is made too weak to aſſimilate the aliments, they then follow their own natural diſpoſition, and degenerate into a ſpontaneous corruption.

The original of an acid, therefore, in the body ſeems to be owing to the aliments not being ſufficiently changed by the action of the body upon them. An acid, therefore, is foreign to the body; for no animal humour, properly ſo called, ever grows acid of itſelf.

Now all vegetable ſubſtances, whether fermented or unfermented, that grow acid of themſelves, may in a body that is weak be alſo converted into an acid; and all the forementioned mealy ſubſtances will at firſt grow thick with water, and form a glutinous paſte, and afterwards turn acid, when fermentation has attenuated that tenacious gluten.

Now the acid thus generated from the aliments in the body is either mild and thoroughly maturated, as are moſt of the acid juices of the ſummer-fruits when ripe, and as likewiſe are the acids produced by fermentation from currants, *&c.* or it has likewiſe an auſtere acerbity joined with it, like unripe fruits, or ſome acid foſſils, which by coagulating the humours increaſe their tenacity.

## SECT. LXI.

THIS acid acrimony (60) has for its antecedent cauſes, 1. Aliments of the mealy, ſucculent acid, freſh, crude, fermenting or fermented, parts of vegetables. 2. The want of good blood in the body that takes down the forementioned aliments. 3. The weakneſs of the fibrous texture of the veſſels and viſcera (24, 29, 41). 4. The deficiency of animal motion.

Here are enumerated the cauſes capable of producing an acid in the body; which may be reduced to two claſſes, being either the aliments degenerating of themſelves into an acid acrimony, or ſuch particulars as weaken thoſe powers of the body which ſhould aſſimilate the aliments into its own nature.

1. Thoſe ſubſtances are enumerated firſt, which ſupply the material cauſe for the generation of an acid.

Mealy.] All meal in general has a mild and almoſt inſipid taſte; mixed with water it becomes glutinous; by fermentation it changes into a ſpirituous liquor; by continuing the fermentation it becomes a ſharp vinegar.

Succulent, *&c.*] Such are all the juices of the ſummer-fruits thoroughly ripe (for before they are ripe there is an auſtere part in them which is not ſo liable to ferment) (*a*), theſe juices are either already acid as is the juice of currants, *&c.* or ſoon turn acid, after fermentation; the ſweet juice of grapes turns to a tartiſh wine, and by repeating the fermentation to a very ſharp vinegar.

Since therefore an acid is the laſt effect of fermentation, hence the more prone theſe juices are to ferment, or the more they have been already fermented, the more eaſily will they produce an acid in weak bodies. The juice of grapes, therefore, when it is newly preſſed and is ſweet as ſugar, inclines leaſt to acidity; it grows more acid, when it begins to be agitated with an inteſtine motion, and has bubbles perpetually breaking up from it attended with hiſſing, which is called fermenting; but is moſt acid when the fermentation is over and it is become wine. Weak men, when they drink wine, fall preſently into ſour belchings, unleſs the wine be oily and very ſtrong, and not eaſily apt to change.

Now follow the efficient cauſes.

2. All the actions of the veſſels and viſcera conſpire to change aliment into our nature, and this partly by the action of the veſſels, and partly by the mixture of fluids already aſſimilated. Good blood contains in it materially all the other humours, bile, ſpittle, *&c.* which humours being ſecreted from the blood follow the nature of the blood, which is good, when it conſiſts of aſſimilated humours, and crude, when the aliments ſtill retain ſome part of their own nature. If there be a deficiency of good blood therefore, the principal power is wanting, which is required to change the aliment into our nature. See §. 25. numb. 1.

3. Theſe have been diſcourſed of already in the forecited places, and there it was ſhewn, how much the

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(*a*) H. Boërhaave Chem. Tom. II. pag. 172.

the ſtrength of the ſolids contributed to the concoction of the food. So that acid and aceſcent food (*i. e.* ſuch as is not yet acid, but diſpoſed to become ſo) diſagrees very much with ſuch perſons as are of a lax habit of body; but in hot countries, where the habit of body is in a contrary ſtate, acids are both pleaſant, and agree very well. When the Roman ſoldiers made war in hot countries, their common drink was vinegar mixed with water, which they called *Poſca (a)*.

4. The chyle, which is prepared by the viſcera deſigned for this purpoſe, is mixed with the blood in ſmall quantities, and flowing with it is changed by the operation of the veſſels and viſcera into milk, and after ſome hours altering its nature is turned into blood. This is wrought by means of the circulation, and chiefly by the action of the lungs. But the more any one exerciſes his body by muſcular motion, the ſwifter is the motion of the humours through the veſſels, and the ſtronger and quicker is the reſpiration; and of courſe the aſſimilation of the aliment is in this caſe both more ſpeedily and more eaſily performed. A hardy plowman, who feeds upon coarſe bread that is already ſour, is very well after it; but let a weak man eat of it and it ſhall turn to a corroding acid, and bring on a moſt troubleſome heart-burn. For which reaſon diſeaſes from an acid are ſo common to young infants, who are ſcarce able to move much their little weak bodies: but as they grow older, run about briſkly, and are ſeldom or never at reſt, they become leſs liable to theſe diſeaſes.

## SECT. LXII.

THE ſeat of this diſorder is principally in the parts where the firſt digeſtion is performed, from whence it by more ſlow degrees infects the blood, and at laſt all the humours.

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(*b*) Nonnius de re cibaria, Lib. IV. cap. 15. pag. 479.

The parts where the firſt digeſtion, *&c.*] All the changes that happen to the aliment by manducation, the actions of the ſtomach, inteſtines, lacteal veſſels, glands of the meſentery, and chyliferous duct, 'till the chyle is diſcharged into the ſubclavian vein, is called the firſt digeſtion. All the veſſels and viſcera, which pour their liquors into any part of this tract, belong to the firſt digeſtion. The effect of this firſt digeſtion is the production of chyle; and chyle always retains ſomething of the nature of the aliment. But in the ſecond digeſtion (whoſe effect is ſanguification) whatever is of a foreign nature is entirely thrown off, and the aliment at length changed into our own. Since therefore an acid is ſomething foreign to the body, and owes its origin to the food we take down, it will more eaſily be generated in thoſe places where the crude humours ſtill retain ſomething of the nature of the aliments, and more difficultly where the aliments are aſſimilated to our humours.

The blood by more ſlow degrees.] Nor does this ſeem poſſible 'till every part concerned in the firſt digeſtion be replete with acid. The very little mouths of the lacteal veſſels and meſeraick veins will not eaſily admit any thing that is acrid; for thoſe moſt tender orifices would preſently be contracted by it: And then the chyle is diluted in the thoracick duct with a very large quantity of lymph; and thus diluted with ſo many humours, it enters the ſubclavian vein in very ſmall quantities; and is then immediately carried away with the torrent of blood, and is no longer to be diſtinguiſhed. So that if there were ſome ſlight acid in the chyle, yet ſo diluted it would not be diſcernible. But the chyle flowing with the blood is ſoon ſeparated from it by the breaſts, and produces milk; which, when freſh drawn, was never perhaps known to be acid; and yet left to itſelf in the heat of the common air, after it is drawn, it will turn ſour. Though I am perſwaded no one will preſume to affirm,

firm, that milk was ever found to be drawn ſour from the breaſts of the weakeſt woman.

Since milk therefore, which falls far ſhort of the perfection of blood, is very ſeldom or never found acid, the blood itſelf will much more difficultly receive an acid taint; and yet that it may do ſo, we have reaſon to believe from what is ſometimes obſerved in diſeaſes.

Thus the ſweat in languid diſeaſes has been ſometimes obſerved to have an acid ſmell; and ſometimes even at the cloſe of acute diſeaſes too.

The drinking too freely of wines diſpoſed to be ſharp has brought on the gout, which has been often cured by the ſparing and repeated uſe of alcaline remedies.

The black feculent blood that ſometimes is lodged in the hypochondria, when reſolved, moved, and excreted by vomit, has ſometimes been found very acid; ſo as to erode even ſtones, and cauſe a very violent efferveſcence when intermixed with earthy bodies.

Bones infuſed in acids will grow ſoft and flexible; many ſorts of aliments are diſpoſed to be ſharp, whoſe nature is changed in a ſound body; but if the changing power be too weak, and this tendency to acidity in the aliments is not conquered; the bones, cartilages, &c. will ſometimes become flexible, as in the caſe of rickety children (*a*).

## SECT. LXIII.

IT produces ſour belchings, hunger, heartburning, iliac pains, flatulencies, inactivity in the bile, and the ſeveral changes which it is ſubject to, acid chyle, and excrements with a ſour ſmell. Theſe are its effects in the ſtomach and inteſtines.

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(*a*) Boërhaave Chem. Tom. I. pag. 737.

Sour belchings.] Belching is the exploſion of ſome elaſtick matter, compreſſed by the convulſive conſtriction of the fibres of the gullet and ſtomach, and now releaſed; and when an acid predominates in the ſtomach and inteſtines, the belching muſt of conſequence be ſour.

Hunger.] Hunger depends on a great variety of cauſes, among which are reckoned all ſtimulants, and acids in particular. But it is a great miſtake, that acids only excite an appetite, as Helmont thought (*a*).

Bile.] The juice of wormwood, *&c.* excites a languid appetite; hunger, indeed, often proceeds from an acid, but not always. This we learn from the moſt rapacious animals, that live on animals only, whoſe ſtomachs have never any acid in them, and yet they are moſt voracious. Infants labouring under diſeaſes proceeding from an acid, have oftentimes a ſtrong appetite, and the nurſe wonders, that eating ſo greedily, the child ſhould not thrive.

Heart-burning] It is a very ſharp pain felt under the *cartilago enſiformis*, in the place uſually called the pit of the ſtomach. The Antients named this diſeaſe καρδιαλγία, καρδιογμὸς, *the heart-burning*, becauſe they aſſigned to the mouth of the ſtomach the appellation of καρδία, or heart, as Galen proves from Nicander, Thucydides, and Hippocrates (*b*). In another place he alſo obſerves (*c*), *quod nulla pars tam accuratum habeat ſenſum, nec utrumque principium una ſecum afficiat, ut os ventriculi, & vulgo & Medicis ſtomachus dictus; dum per nervos adeo magnos cerebrum, ſitus vicinia cor, afficit;* "that no part has ſo delicate a ſenſe, or affects the "two principal parts of the body, ſo much as the "mouth of the ſtomach; for by its nerves, which "are ſo large, it affects the brain, and the heart by "the nearneſs of its ſituation."

For

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(*a*) Pag. 164. 24. (*b*) De Hippocr. & Platon. placitis, Lib. II. cap. 8. Charter. Tom. V. pag. 108. & Comment. in Lib. II. Epidem. Charter. Tom. IX. pag. 124. (*c*) De ſymptom. cauſis, Lib. I. cap. 7. Charter. Tom. VII. pag. 57, 60.

For the ſtomach itſelf ſeems not ſo ſenſible, as its upper orifice: for while an acid lies quiet in the ſtomach it cauſes no pain: but as ſoon as by belching it is thrown upwards, or by the motion and different poſition of the body it falls upon the upper orifice; preſently then comes on this moſt diſagreeable pain, this heart-burning may be not only from an acid, but from any other acrimony irritating the *cardia* or mouth of the ſtomach.

Iliac pains.] The acid being thus produced in the ſtomach, if it be not changed by the bile from the heat and delay it makes in the inteſtinal tube, ſhall grow more acid ſtill, and hence may cauſe exceſſive pains by eroding and vellificating its fibres; whence gripings in the belly are ſo frequent to children.

Flatulency, ſpaſms.] Whilſt the air is unconfined in the ſtomach and inteſtines it does no hurt: but it appears by experiments made on living animals, that if the inteſtine be touched, *v. g.* with ſpirit of vitriol in any place, it is immediately drawn together with a ſtrong ſpaſm: if it be touched again in another place, at a ſmall diſtance, it is conſtricted thereto: and preſently the intermediate part of the inteſtine is inflated by the rarefaction of the air within. When therefore an acid by its irritation produces ſpaſms in the inteſtines, by which they are contracted in ſeveral places, the air within rarefies and diſtends them, and when the ſpaſm is relaxed, it paſſes upward or downward with violence; or elſe ſhifting its place only, it wanders through the inteſtines with a murmur called borborygmos or rumbling of the guts. Add to this, that every thing in fermenting generates elaſtick matter very copiouſly. So that the cauſe why flatulency ariſes from an acid is two-fold; from the irritation, by which the fibres of the inteſtines being drawn into a ſpaſm keep in the included air; and from the elaſtick matter, which is generated in all liquids that are apt to ferment; on both which accounts thoſe who ſuffer under an acid are ſo ſubject to flatulencies.

Inertneſs in the bile.] As ſoon as the chyle paſſes through the pylorus into the duodenum, it is mixed with both ſorts of bile, which contribute very much to the changing the foreign humour into natural. But of all the humours that are not excrementitious, the bile is the moſt acrid, and ſooneſt liable to putrefy: and for this reaſon it is, that dead bodies ſooneſt putrefy near the liver. This therefore mixing with the chyle oftentimes deſtroys the too great tendency it has to ſharpneſs, divides and diſſolves whatever it meets in its way, and diſpoſes it to an equable mixture. Thus beer and ale are corrected with hops, which is a very bitter plant, and nearly reſembling bile, that they may not grow ſour. In all caſes therefore, where the bile predominates, the nature of the bile is in a manner inverted, and its efficacy rendered almoſt fruitleſs. This is ſeen in the caſe of infants labouring under an acid; for the milk in their ſtomachs turns to a curd not unlike to cheeſe, which is diſſolved by the bile, whilſt it is in a good ſtate, and then the ſtools will appear yellow, and alike in all parts; but if the effect of the bile is overcome by the prevailing power of the acid, white lumps of this cheeſe-like curd will be diſcharged at the ſame time with the ſtools.

If the bile of other animals be ſomewhat inſpiſſated, then made into pills, and given in a ſmall quantity every day, it would prove an exceeding good remedy in this caſe. The ſtability of health depends very much upon a due ſtate of the bile: for if it abounds or is too acrid, putrid diſeaſes will follow; and chronical, if it is deficient or rendered incapable of action; many of theſe diſeaſes take their riſe from a bad digeſtion in the firſt offices; and deſtroy the health by ſlowly corrupting the humours.

Its various changes.] Whilſt infants are well, the ſtools are yellow and in all parts alike: when an acid begins to prevail, the ſtools are yellow indeed at firſt, but after they are expoſed to the air will within half an hour turn green: as the diſeaſe increaſes, they are green at firſt, and indeed ſometimes of ſo deep a colour, that like copperas they will ſtain the linen, ſo as hardly to be waſhed out. For which reaſon the quantity and acrimony of the acid in infants may be judged of from the colour of their ſtools.

It is true indeed, that ſuch æruginous bile may proceed from other cauſes, as ſhall be ſhewn in another place; but in this tender age it almoſt wholly ariſes from a prevailing acid.

Acid chyle, ſtools ſmelling ſour.] If the ſtomach and inteſtines be thus full of acid, then alſo the chyle may be acid too, as is very evident; but in this caſe it cannot eaſily enter the very little mouths of the lacteals, as they are contracted by every thing that is acrid. At length the ſtools alſo will ſmell ſour, as is often obſerved in infants, which ſhew that the ſeveral viſcera employed in the office of the firſt digeſtion abounds with an acid; and at the ſame time points out the great danger there is in the caſe.

## SECT. LXIV.

IN the blood it produces paleneſs, a chylous acid ſerum; hence in women, acid, or rather too aſceſcent, milk, acid ſweat, acid ſpittle; from whence come itchings, obſtructions, puſtules, ulcers, too ſpeedy coagulations of the milk, and perhaps of the blood itſelf, and an unfitneſs to circulate, irritation of the brain and nerves; whence convulſions, an interrupted circulation, and death.

Paleneſs.] All perſons that have a predominant acid look pale; as appears in infants, girls, and men of a lax habit. This ſhews the deficiency of the moſt ſolid red part of the blood; and where this fails, the aſſimilation of the crude humours is never carried on ſo well as it ought to be, and they more eaſily degenerate into a ſpontaneous corruption. Paleneſs therefore is to be conſidered not only as the effect of a preſent acid, but alſo as the preſage of a future acid, through the weakneſs of the aſſimilating powers. Beſides, acids taken inwardly ſeem to bring on a paleneſs; thus vinegar applied to the lips will make them look pale. Such perſons, as are employed in making vinegar of wine or beer, from being daily converſant in an air replete with acid vapours, are oftentimes obſerved to grow pale.

A chylous acid ſerum.] This muſt be diſtinguiſhed from the concocted ſerum of the blood, which is yellow, concreſces by the fire, and is never found to be acid or aceſcent; but is apt to putreſy when left to itſelf. By the chylous ſerum is here meant the chyle itſelf, when not ſufficiently ſubdued by the powers of the body while it is circulating with the blood; ſo that it retains its own nature too long, by which it inclines to acidity: for from the chyle circulating with the blood is generated milk, and this milk, by the efficacy of the circulation, when continued for four and twenty hours, will be changed into ſerum and red blood; but if this changing power be too weak, it will either not alter the nature of the milk, or at leaſt not ſo ſoon: and conſequently the ſharp diſſolution of the milk may remain, and an acid be produced even in the blood itſelf.

Hence in women an acid, or rather too aceſcent, milk.] Milk is ſeldom or never obſerved to be acid in the breaſts; but it may be eaſily in ſuch a ſtate as to be capable of turning acid very ſoon. If an healthful woman ſhall abſtain from eating or drinking for four and twenty hours, ſhe will have no milk in her breaſt, but a kind of yellowiſh ſalt ſerum, which the child will diſlike. And the reaſon is, becauſe all the milk is at this time changed by the laws of circulation into a ſerum, and become a natural humour. If now theſe changing powers be too weak, the milk will retain its diſpoſition to turn ſour ſo much the longer; ſo that it will become acid the ſooner, the leſs it is digeſted. But this depends upon the ſtrength of the body, and the time the milk continues in the veſſels wherein it flows with the blood; and hence it appears why milk turns ſour ſooner, that is drawn from the breaſt ſoon after eating, or from the breaſts of a weak nurſe.

Acid ſweat and acid ſaliva.] This circumſtance is leſs frequent, and never occurs but in very weak people; yet it is plain, that if the blood may have an acid in it, all the humours ſecreted from it may have an acid alſo.

Itching.] We ſee that all ſharp humours, when they arrive at the ſkin, will occaſion itchings, obſtructions between the ſcales of the ſkin, puſtules, *&c.* in the jaundice the bile, when carried to the ſurface of the body, ſhall often raiſe an intolerable itching. If the humours infected with an acid acrimony flow to the ſame part, the ſame effect will be produced. By eating unripe and crabbed fruits the children of country-people often labour under diſeaſes of the ſkin attended with a moſt violent itching. In the firſt ſtage of life infants are often afflicted with ſurpriſing eroſions of the ſkin.

Too ſpeedy coagulations of the milk.] If the milk incline too much to acidity, and ſtagnate in the lactiferous receptacles of the breaſts, it may poſſibly turn acid there; a thin ſerum will in this caſe ſeparate from the curdled part and flow through the nipple, whilſt the thick part left behind may poſſibly occaſion hard tumours, inflammations, *&c.* And yet inflammations from a coagulated milk in the breaſt are much more frequent after a fever than before; and then it is rather an alcaleſcent degeneration. *Fortè centies Medici obſervant, lac coagulari ſic à febre, ubi ne ſemel id vident factum ab acido* (*a*); "Phyſicians perhaps ſhall ſee "milk

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(*a*) H. Boerhaave Chem. Part II. pag. 303.

“ milk thus coagulated by a fever an hundred times “ together, and it may be not once coagulated by an “ acid.”

Coagulations alſo of the blood itſelf.] The ſtrongeſt foſſile acids coagulate the blood: the milder vegetables rather dilute it: hence probably it very ſeldom happens that an acid generated in the body can coagulate the blood; yet if the *artra bilis*, which, as the Antients obſerved, is ſometimes ſo acid as to ferment with earth, and erode ſtones like *aqua fortis*, be mixed with the blood, it may certainly cauſe a fatal coagulation of it.

Irritations of the brain and nerves.] it is certain, that if any thing acrid could poſſibly touch the tender fabrick of the brain and nerves, all the functions that depend thereon would be diſturbed. Such acrid things can ſeldom arrive at theſe minute veſſels. Nature has been ſollicitouſly careful to prevent their admiſſion by faithful guards in every part Men ſwallow the moſt acrid ſubſtance without prejudice, which would deſtroy the brain, if they could be carried thither. If the leaſt quantity of ſmoke but fall upon the eye, the eye-lids preſently cloſe; or if it be drawn up by the noſe, what a violent ſneezing will it bring on; if ſucked into the lungs, a cough ſhall enſue to expel this enemy; or if an acid be thrown into the ſtomach and inteſtines, exceſſive vomiting and fluxes ſhall follow, *&c.*

And whatever part the acrid matter be in, almoſt all the humours of the body are brought thither from their own ſeats to waſh it away; and when we ſee a law thus takes place in all the greater organs, we have good reaſon to think it does ſo in all the leſs. It is certain the cortex of the brain, ſeparated from all its blood veſſels, has a very inſipid taſte, and applied to the eye gives no pain. Hence acids cannot ſo eaſily enter the leaſt veſſels, as many have thought; but it ſeems to be for another reaſon, that irritations of the brain and nerves, with numberleſs other miſchiefs following thence, may ariſe from an acid in the *primæ viæ*; for the nerves that are diſperſed through the ſtomach and inteſtines have a ſurpriſing dominion over every part of the body, as we learn by certain experience. If a worm by its creeping irritates theſe parts, it ſhall often occaſion convulſions: an hernia pent up ſhall often cauſe ſudden death, and even before this circumſtance happens ſhall ſometimes bring on all the ſymptoms of a diſordered brain. Atra bilis in theſe viſcera will ſtrangely overſet the whole mind: poiſons ſwallowed, and ſtill remaining in the ſtomach, ſhall diſturb the frame of the whole body, 'till death enſues: opium, as ſoon as taken, and whilſt it continues in the ſtomach almoſt undiſſolved, ſhall appeaſe every pain, and ſtop too violent evacuations, *&c.* hence an acid, when formed in the offices of the firſt digeſtion, may poſſibly cauſe wonderful diſeaſes, and even death itſelf, by the irritation only of the nerves; nor is it requiſite to produce this effect, that the acid ſhould mix with the blood, and ſo enter into the inſide of the brain and the nerves. Though this is moſt likely to be the caſe at that age, when the whole ſyſtem of the nerves is moſt moveable: for which reaſon infants are ſo frequently convulſed, when labouring under an acid.

## SECT. LXV.

FROM what has been ſaid (60, 61, 62, 63, 64, 65) we may eaſily learn, when this acid temperament is preſent, future, or paſt; from hence alſo its effects may be foreſeen; and its cure eaſily known.

The preſent acidity is known by a paleneſs of colour in the corners of the eyes, the inſide of the mouth, the jaws; the lips; by ſour belchings; little or no thirſt; coldneſs and laxity of the whole body;

by the ſtools ſmelling ſour; the urine looking white like water; the appetite being generally large.

Future.] If the Phyſician knows the habit to be weak and lax, and blood diſſolved, the courſe of life unactive, or a great loſs of blood to have preceded, and then that ſuch diet has been uſed, as ſpontaneouſly degenerates into an acid acrimony; he may ſafely foretel the ſpeedy generation of it in ſuch a body, as he ſees theſe two particulars joined together, an acid diet, and powers too weak to correct it.

The paſt will be eaſily underſtood from what has been ſaid.

Its effects.] Which will be various, as has been mentioned, according as the acid taint infects either the *primæ viæ* only or the blood itſelf too: and again, where we obſerve the effects of a predominant acid, there we may know it to be preſent.

From all which the requiſites to a cure eaſily appear.

## SETT. LXVI.

WHICH is to be affected: 1. By aliments both animal and vegetable that are of a nature oppoſite to an acid. 2. By juices as nearly reſembling good blood as it is poſſible, ſuch as thoſe of birds of prey. 3. By ſtrengthening things. 4. By ſtrong motion. 5. By medicines that abſorb, dilute, blunt, and change, acids.

If all diſeaſes were from acids, as a certain ſect of Phyſicians have held, the art of phyſick would be a very ſhort one. For if a man laboured under the worſt degree of this diſeaſe, he might be cured I think in a few days, provided his viſcera were ſound; and this by diet only without medicines, if he lived only on fleſh or fiſh or broths, and drank only water.

1. No animal tends to acidity of itſelf, but always to putrefaction. All food therefore of the animal kind is oppoſite to an acid: but roaſted fleſh is more eſpecially ſo: fiſh is particularly good in this caſe, becauſe it putrefies much ſooner than fleſh: eſpecially ſuch kinds of fiſh as devour other fiſhes, ſuch as pike, *&c.* Broth alſo and jellies muſt be ſerviceable in this caſe; for even the jelly of hartſhorn will putrefy in the ſummer-time in two days.

Vegetables.] Moſt vegetables incline to an acid, yet not all. All bitter vegetables reſiſt acidity; and for this reaſon they preſerve beer, by infuſing theſe in it, from growing ſour. Almoſt all the kinds of cabbage putrefy of themſelves; and the decoction of cabbage hath certainly ſomething of a ſubputrid ſtink: all the acrid antiſcorbutick plants putrefy and will not ferment, ſuch as the ſcurvy-graſs, horſe-raddiſh, muſtard, *&c*, nay when diſtilled freſh they yield a volatile alcaline ſalt; which makes them ſo uſeful in cold ſcorbutick diſeaſes, ſince they both reſiſt acids, and excite the languid functions by their powerful ſtimulus.

And drink only water.] For all beer will turn ſour. Or if the patient's weakneſs requires wine, uſe a ſtrong oily ſort, ſuch as Spaniſh, Hungarian, or Canary, wines, and give ſome abſorbent thing after it to deſtroy its acidity.

2. In the *materia medica* you have a catalogue of thoſe birds that live on other animals, whoſe fleſh therefore is moſt liable to putreſy. An ox feeds only on graſs, has fleſh conſiſting only of graſs changed by the powers of the body; the fleſh of that animal therefore approaches in ſome meaſure to the nature of vegetables. But when fowls live on a food that is originally animal, their nouriſhment partakes of an animal nature, which is ſtill farther perfected in the body that ſwallows it, and for this cauſe it is, that ſuch birds as live on other animals have that high reliſh: nor can any man live on them long without uſing acid ſauces or ſalt; ſo apt are they to putreſy.

Three things are required to cure the prevalence of an acid in the body: 1*ſt*, ſuch food, as is never naturally changed into an acid, but is apt to aſſume a quite oppoſite nature, of which we have already treated in the two firſt numbers of this paragraph; 2*dly*, The actions of the body, which aſſimilate the food we eat into our nature, are to be excited and ſtrengthened; 3*dly*, The acid, that is already in the body, and if care be not taken will do miſchief, is to be corrected and rendered inaffectual, and this we ſhall learn to do from the laſt number of this paragraph.

3. Theſe corroborants have been treated of numb. 4. §. 28. the auſtere acids often deſtroy acids in the body, not by the mixture of their ſubſtance, but by means of the laſt effect, whereby they ſtrengthen the actions of the veſſels and viſcera. Yet thoſe are to be preferred generally, which have a ſtrengthening power without an acid. Brunſwick mum excels the reſt. This is a ſyrup of wheat as it were, and abides the exceſſive heats of India without a change, and in all languid diſeaſes is more ſerviceable than could almoſt be expected: ſo likewiſe all wines, but eſpecially ſuch as are oily and ſtrong, are anti-acids, as they ſtrengthen and increaſe motion; and particularly if any ſpicy ſtimulating ingredients be added to them.

4. What exerciſe does to ſtrengthen a lax body has already been obſerved §. 28. numb. 2. hereby likewiſe the action of the veſſels and viſcera is increaſed, by which the aliment is changed into the nature of our humours, which always tend to putrefaction. By violent exerciſe the urine becomes more acrid, and emits ſomewhat of a putrid ſmell; the ſweat looks yellow and ſmells ſtrong; and the body is even diſpoſed to fall into acute putrid diſeaſes through an exceſs of labour. Phyſicians often wonder, that when the acid has been ſubdued in the beſt manner that was poſſible, yet that the perſon thus reduced ſhould be apt to fall back into the ſame diſeaſes again. But the reaſon is for the moſt part, becauſe they neglect to

ſtrengthen the body by exerciſe: for the diſeaſe certainly returns, unleſs the muſcular motion be increaſed, or its defect ſupplied by ſtrong frictions. Thus we ſee country-people, who live on ſour rye-bread and butter-milk, &c. ſhall conquer it by hard labour, and find no diſſervice from it.

5. Medicines that abſorb acids.] The chief of theſe are enumerated in the *materia medica*. Theſe are ſuch medicines as have the peculiar property of attracting a latent acid, of ſeparating it from the other parts of a liquid, and in a manner uniting into one maſs with it.

Upon very pure ſpirit of vinegar I poured by degrees the powder of crabs eyes; this was followed with an hiſſing and an effervеſcence, and the powder ſeemed to be diſſolved; yet ſo as that when this effervеſcence was over, a conſiderable number of flocculent parts ſeparated from the liquid, and fell by degrees to the bottom; upon moving the veſſel theſe parts however were equally mingled again with the liquor which ſwam above them. I proceeded to add more powder 'till it fell to the bottom undiſſolved, and there remained no more ſign of any effervеſcence. I then filtrated the liquor, and found it ſomewhat acid to the taſte, and yet when mixed with ſyrup of violets it made no change in its colour. This clear liquor I put into a tall cucurbit, and placing an alembick upon it, I diſtilled it with a very gentle fire, and found that it yielded a conſiderable quantity of burning ſpirit, which had not the leaſt ſign of any acid in it After this ſpirit, by increaſing the fire, I obtained a water, which by its ſmell and taſte I ſuſpected to be ſomewhat acid; yet it changed not the ſyrup of violets red; nor cauſed any effervеſcence when mixed with oil of tartar *per deliquium*, nor wrought any change in a ſolution of the *mercurius ſublimatus corroſivus* made in pure water. I proceeded to inſpiſſate the remaining liquid 'till it was almoſt dry: its taſte was then ſalt and inclined to be bitter: I concluded therefore that the acid of vinegar reſided in this reſiduum united with the powder of crabs-eyes. To this I then added a ſtronger acid, *i. e.* oil of vitriol, that I might divert the acid of the vinegar from adhering to the crabs-eyes; and then diſtilling it out of perfectly clean veſſels with the moſt gentle fire, I obtained a very acid ſpirit extremely volatile, and of a moſt penetrating ſmell.

Since therefore the production of vinegar ſeems to depend on the combination of a burning ſpirit with a more fixed acid, which lay concealed in the wine (*a*); it is plain from the foregoing experiment, that crabs-eyes have a power to ſeparate the acid from the other parts of the vinegar, and unite with it in ſuch a manner, as that whilſt that union laſts, it ſhall no longer act as an acid.

Hence appears that uſefulneſs of abſorbent powders. For theſe ſeem to be in a manner torpid of themſelves, and active only when they meet with an acid; in the mean time they offend not the body by any acrimony of their own.

One thing only remains to be obſerved, that in the ſhops it is cuſtomary to grind theſe ingredients on a marble to an impalpable powder, in order to make them mix more equally with a liquid, and to hinder them from feeling gritty in a diſagreeable manner between the teeth: but then they get a new quality of running into concretions with meer water, and much more with the glutinous humours, which may occur in the *primæ viæ*; and then if there be not acid enough preſent to diſſolve them, they will form maſſes which cannot eaſily afterwards be reſolved, but will offend both by their ſize and weight.

It appears not from any obſervation, that the moſt coſtly pearls are preferable for this uſe to common crabs-eyes.

This action of all abſorbents, whereby they deſtroy acids,

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(*a*) Boërhaave Chem. Part II. pag. 214.

acids, ſeems to take place only in the viſcera wherein the firſt digeſtion is performed

Medicines that dilute.] That is water and every other liquid in which water is the prevailing ingredient. Oil of vitriol burns every part of the body that it touches; and yet if diluted with a great quantity of water it ſhall do no hurt. But as an acid commonly prevails in weak bodies, and water diluents tend to make them weaker, (ſee §. 35. numb. 1, 3.) and weakneſs has been aſſigned as one cauſe of producing an acid in the body: (ſee §. 61. numb. 3.) the abſorbent medicines for this reaſon are to be preferred to the diluent.

Medicines that blunt.] Theſe are ſuch medicines, as by their ſoft and oily particles in particular ſo caſe up every thing that is acrid as to make it inactive; and at the ſame time defend all the parts of the body, which they cover, from eroſion. When the Surgeons attempt to erode any part with the *lapis infernalis*, or corroſive mercury ſublimate, which has the moſt concentrated acid joined to the metal, they defend the parts adjacent by covering them with ſome fat or oily ſubſtance. If acrid poiſon has been ſwallowed, there can be no better application than to drink a large quantity of oil. That moſt ſharp acid of vitriol if united to oil is converted into a mild ſulphur; which though almoſt inſipid, ſtill contains within it that corroſive acid. And for this reaſon it is, that very ſoft oils are ſo beneficial to infants who labour under an acid. And yet they have this inconvenience attending them, that they are apt to weaken the tone of the ſolid parts. (See §. 35. numb. 3.)

Broths alſo made from the parts of animals, inſpiſſated into jellies, are here alſo beneficial, as they inviſcate acids by their glutinoſity, and are always naturally diſpoſed to putrefaction.

Medicines that change.] Theſe are ſuch medicines, as meeting an acid unite with it into a new kind of ſalt, that is neither acid nor alcali, but what the Chemiſts call a neutral and compound ſalt, which is one of the beſt kinds of reſolvents. When the acrid liquor of ſalt of tartar *per deliquium* is mixed with the very acid oil of vitriol, a mild compound ſalt is produced, called in the ſhops vitriolated tartar, which is one of the beſt deobſtruents we have.

Such are alſo all the fixed alcaline ſalts drawn from a lixivium of the aſhes of vegetables: as alſo all the volatile ſalts of animals and vegetables. To this claſs may be reduced alſo all ſoaps, made of oil and an alcaline ſalt, whether fixed or volatile.

## SECT. LXVII.

WHEREOF the choice, preparation, doſe, and ſeaſonable application, will be known to the Phyſician from his knowledge of the diſeaſe, its ſeat, the patient, *&c.*

The choice.] Of the remedies recited in the foregoing paragraph, thoſe are to be preferred, which are moſt agreeable to the various nature and ſeat of the diſeaſe, and the different diſpoſition of the patient. We ſeldom give alcaline ſalts fixed or volatile to young children, or at leaſt in a very ſmall quantity: becauſe unleſs they preſently meet the acid, they may do as much miſchief by their acrimony as the acid itſelf. But we give them abſorbents, which have no acrimony to be of prejudice, or ſoaps, in which the acrimony of the alcali is ſo inviſcated by oil as to be incapable of doing harm. In the mean while they reſiſt acids moſt powerfully. If the ſtomach or inteſtines be excoriated by the eroſion of an acid, we fly to oily medicines and animal jellies. If beſide the acid there be a glutinous lentor in the *primæ viæ*, which would make the abſorbent powders uſeleſs; we have recourſe to the fixed alcaline ſalts, which will divide that glutinous viſcidity, and change the acid into a neutral ſalt. If the acid taint hath at laſt infected the blood, cauſing cold and ſluggiſhneſs, as is commonly the caſe: the volatile alcaline ſalts are of ſervice, as they likewiſe excite the languid power of life by their ſtimulating property. Fixed alcaline ſalts are likewiſe ſerviceable, as they ſeem capable of entering the blood by being diluted by the chyle. The uſe of abſorbents is leſs proper, as they do not ſeem ſo capable of entering the lacteal veſſels. But if you would ſtrengthen the body at the ſame time, filings of ſteel are to be preferred to every other medicine.

Preparation.] The alcaline ſalts, whether fixed or volatile, are beſt given diluted in pure water. If there is reaſon to apprehend that a troubleſome flatulence ſhould follow upon the meeting of the alcali and acid, it is moſt adviſeable to give an alcali boiled up with oil into a ſoap. Nor ſhould the abſorbents be too finely powdered, as we have already obſerved. There is in ſome ſhops alſo another preparation of the abſorbents, which in my opinion ſeems to be of little uſe, made by diſſolving theſe powders in diſtilled vinegar, and then precipitating them with oil of tartar *per deliquium*; this precipitate powder is waſhed, preſerved, and called a magiſtery. I have found the magiſtery of crabs-eyes thus prepared to be only a very fine powder, which raiſes an effervеſcence, and diſſolves in diſtilled vinegar, as before. This labour therefore is of no benefit: nor is it true, as ſome have ſaid, that theſe magiſteries will not again ariſe into an effervеſcence with acids.

Doſe.] As to the abſorbents one hardly can err, they being ſafely given in a large doſe, and not active enough to do any harm. Nor is there need of great caution as to the diluents and obtundents. But as the ingredients that change acids are all acrid, they require a more limited doſe, as is obſerved in the *materia medica*.

Seaſonable application.] If there be an acid in the *primæ viæ*, it is beſt to carry the anti-acids through the whole tract of the inteſtines, by adding to them ſome light purging ſtimulus. If it be in the blood, the volatile alcaline ſalts are particularly ſerviceable, eſpecially if the body is hereby diſpoſed to ſweat at the ſame time.

If a child at the breaſt labours under an acid, we may weaken and deſtroy the preſent acid; but we cannot give it an alcaleſcent diet, as it loaths almoſt every thing but milk. Is is proper therefore to order the mother ſuch a diet as will make the chyle and milk aſſume a nature moſt remote from an acid. For this ſee §. 96. numb. 1, 2, 3, 4.

## SECT. LXVIII.

HENCE it appears why this diſeaſe is ſo common to children, to the ſlothful, to virgins, to the poor, and to certain tradeſmen.

Why to infants.] Theſe live almoſt entirely upon the milk of their mothers, or on mixtures of mealy ſubſtances with water, bread, and the milk of other animals; their ſolids are very tender; and they have ſcarce any exerciſe.

The ſlothful.] The actions of all the veſſels and viſcera are weakened by living in eaſe and idleneſs without exerciſe; the aliment is not aſſimilated, but degenerates into a ſpontaneous corruption; and as the greateſt part of the food we take down is capable of turning ſour, ſuch as bread, beer, wine, and many kinds of herbs; it is no wonder that ſuch perſons abound with acids.

To virgins.] Becauſe they have a more lax habit of body, and are too much given to a ſedentary life, if they be of the richer ſort; and thoſe that are poor get their living by ſome ſedentary work, and delight too much in drinking warm tea, *&c.* at leaſt in this country.

The poor.] Becauſe they can ſeldom eat fleſh in this country, and live chiefly on milk-meats, butter-milk, barley, oats, buck-wheat, rice and herbs, and ſmall beer: many of them get their living by ſome ſedentary trade, or ſome buſineſs at leaſt which does not require a ſtrong motion.

Why to certain tradeſmen.] Such perſons, as are obliged by their trade to ſpend whole days in an air full of acid fumes, generally labour under this diſeaſe. For the bibulous veins, which cover the whole ſurface of the body, abſorb a conſiderable quantity from this air; the ſame air is drawn into the lungs, and paſſes through the ſtomach and inteſtines; ſo that the whole body is at length filled as it were with an acid. For this reaſon we ſo frequently ſee thoſe, whoſe buſineſs it is to make beer, vinegar, aqua-fortis, *&c.* look pale, languid, and ſwelled; ſo large a quantity of acid entering the body every day, as cannot be conquered by its ſtrength and motion.

## DISEASES from a ſpontaneous GLUTEN.

## SECT. LXIX.

A Glutinous fat from vegetables has theſe antecedent cauſes, 1. mealy ſubſtances, crude, crabbed, and unripe, fruits. 2. A want of good blood. 3. Weakneſs of the veſſels, the viſcera, and bile. 4. A defect of animal motion. 5. A diſſipation of the more liquid part through too great a relaxation of the ſecreting veſſels. 6. The retention of the thicker part through the weakneſs of the excreting inſtruments.

As many Phyſicians have deduced almoſt all diſeaſes from an acid, ſo have others from a pituitous matter. This they have found fault with on all occaſions, have inſiſted upon its being extirpated at all times, though many and very difficult diſeaſes frequently ariſe from the want of it.

By a glutinous body we mean a ſubſtance, which in ſome ſort approaches to the nature of a fluid, but whoſe parts cohere with ſo much tenacity, as to admit of being drawn into threads A glutinous ſubſtance therefore is as it were of a ſemiliquid nature, but has ſuch a lentor in its parts, that when moved they in a manner ſtill ſtick together.

There is a lentor in all the human liquids, except perhaps in thoſe that are moſt ſubtle, and ſome that are excrementitious; the blood and its ſerum, the bile, ſpittle, &c. have a certain tenacity, which is requiſite to health: as ſoon as the blood loſes this plaſtick lentor, and become too thin, a dropſy will follow.

But there are ſome liquids ſecreted from the blood, which have a very good right to be [illegible]ous, *v. g.* the unctious liquor that ſerves [illegible] the joints; the natural mucus that defends and lubricates moſt of the membranous parts, as in the gullet, ſtomach, and inteſtines: the inſide of the arteries too are lined with ſuch a mucous covering.

For which reaſon every thing glutinous is not to be condemned as though it were morbid; ſince a pituitous ſubſtance by the laws of the body may be produced in the moſt perfect health, and be attended with ſuch good uſes.

In this chapter therefore we ſhall treat of that morbid gluten, which owes its riſe either to the aliments being of too glutinous and tenacious a nature; or to an exceſs in the natural pituita, either as to its quantity or its tenacity.

The Ancients ſuppoſed the pituita to be two-fold; the one burnt as it were and too much concocted, called *phelgm*, (ἀπὸ τοῦ φλέγεσθαι, which ſignifies *burnt*) and the other of a white colour, by all termed *pituita*, and by Prodicus termed βλέννα, or *mucus*, in his treatiſe of the nature of man (*a*).

The former was an hot phlegm, and called phlegma phlegmonodes; the latter was a cold thick humour, and called ſimply *pituita*, or cold phlegm.

The hot phlegm often appears in blood drawn from the veins in inflammatory diſeaſes, where its ſurface is covered with a white tenacious covering reſembling leather; cold phlegm is what is ſecreted ſo largely in catarrhs.

Now then we are to conſider the cauſes, which from the forementioned particulars may occaſion the production of too great accumulation of pituitous matter in a ſound body.

1. All mealy ſubſtances mixed with water grow thick more or leſs. Starch, which is a very fine powder, becomes glutinous, as every body knows. The flower of linſeed mixed with water forms a moſt tenacious paſte, which cannot be digeſted, as has been already obſerved §. 25. numb. 1. And this more eſpecially holds good, if theſe ſubſtances are taken crude: for after fermentation, though it be ſlight and inconſiderable, the tenacity is broken; as is plain from bread. And this is the cauſe of the many diſeaſes which prevail among the poor, as they live almoſt wholly on mealy ſubſtances crude, and in the mean time do for the moſt part get their living by a ſedentary trade.

Crabbed unripe fruits.] Theſe have the power of drawing the elementary particles nearer together, and giving a greater lentor to the fluids. Let but any one taſte of an unripe medlar, and he will ſtreight feel the whole inſide of his mouth parched and contracted, and the ſpittle inſpiſſated. And if the like crabbed ſubſtances be ſwallowed, they will operate in a reſembling manner in the ſtomach and inteſtines. The

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(*a*) Galen. de natural. facultat. Lib. II. cap. 9. Charter. Tom. V. pag. 50.

The children of country-people eat greedily of unripe fruits, and generally ſuffer for it by a ſwelled belly, a pale face, and a languor of the whole body.

2. A due quantity of good blood was juſtly reckoned among the cauſes that change the aliments into our humours, as has been ſhewn §. 25. numb. 1. and §. 43. numb. 3. where this is wanting the glutinous aliment retains its own nature, and is not thoroughly changed. Such perſons as have loſt too large a quantity of blood grow tumid, and languiſh under a cold lentor: for good blood attenuates all viſcidities by its motion and heat. Hippocrates has a remarkable paſſage that confirms this truth *(b)*; he ſays, *cum in utero gerat mulier, tota fit cum virore pallida,* (χλωρὴ,) *quòd purus ipſius ſanguis quotidiè ex corpore deſtillet, & ad fœtum feratur, illique incrementum fiat, & pauciori in corpore ſanguine exiſtente, eam ex viridi palladam eſſe neceſſe eſt*; “ when a woman is with child, ſhe becomes pale and green, (χλωρὴ,) becauſe her good “ blood paſſes from her every day, and is ſpent on the “ growth of the fœtus; having leſs blood in her bo- “ dy therefore, ſhe muſt of neceſſity look pale and “ greeniſh.”

3. The due ſtrength of the veſſels and viſcera changes the crude aliment into the nature of our own humours; if increaſed it cauſes the hot viſcidity or phlogiſtick diſpoſition in the blood, which is the very reverſe of that pituitous viſcidity we are ſpeaking of. For which reaſon ſuch as are robuſt, and uſe hard labour, may live upon a mealy diet without prejudice; while the weak and the idle have the viſcera of the abdomen immediately obſtructed by it.

The bile.] The bile is ſecreted from the venal blood of the abdominal viſcera by the liver; it is poured into the duodenum, and mixes with the chyle as ſoon as it comes out of the ſtomach; by its ſoapy nature it diſſolves the aliment, diſpoſes it to an uniform mixture,

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(*b*) De mulierum morbis, Lib. I. cap. 32. Charter. Tom. VII. pag. 748.

ture, and divides and attenuates whatever is glutinous or viſcid. Calves feed only on milk, this milk in their firſt ſtomach is turned into curds and whey: this curd in the ſecond and third ſtomach grows by degrees more coheſive and thick; in the fourth ſtomach it has ſcarce any juice left: but when it paſſes into the duodenum, and the bile comes to be mixed with it, it is all entirely diſſolved; ſo great is the power of the bile. For this reaſon bile is uſed like ſoap to clean ſilk withal; and the painters dilute their ſtiffeſt colours with it, to make them ſpread more equally. When therefore the bile is grown inert, and does not diſcharge its office in due manner, the glutinous aliments and the pituitous ſubſtance, which naturally lines the inſide of the ſtomach and inteſtines, are increaſed, become more tenacious, and bring on very ſevere diſeaſes; which are not to be cured but by making the bile more acrid, or ſupplying its place with bitter ſoapy medicines. It often happens, in autumnal fevers eſpecially, that where the bile, grown too acrid or almoſt putrid, is too largely evacuated either by nature or art, unleſs thoſe perſons after they are cured uſe bitters to compenſate its loſs, they ſhall languiſh under cold pituitous diſeaſes a conſiderable time after.

4. The natural gluten, that ſerves to lubricate and defend the parts, is always accumulated in ſuch perſons as live a ſedentary inactive life, and their bodies thereby become lax and tumid, and full of glutinous humours. For by due exerciſe the motion of the humour is increaſed, and whatever would otherwiſe be apt to ſtick in the veſſels is carried off. When the limbs are at reſt, the mucous liniment of the joints accumulates by degrees, and often cauſes anchyloſes, that are ſcarce curable. The ſtomach and inteſtines have their internal ſurface lined with a viſcid mucus; when the body is ſtrongly exerciſed, reſpiration is increaſed, and by the reciprocal action of the diaphragm and the abdominal muſcles, it moves all theſe viſcera, preſſes them cloſe together, and rubs them againſt

each other, 'till by this means they are all deterged. The viſcid oily ſubſtance, which is collected from animals well fed, and at reſt, in ſuch large quantities, is attenuated, and again diſperſed, by muſcular motion.

5. This is a frequent cauſe of viſcidity in our humours, though ſeldom thought of. For moſt of our humours have the property of running into concretion, when a ſmall portion of their more liquid part is carried off. Such viſcid mucous concretions may happen even in the very ſubtle perſpiring lymph by inſpiſſation, and ſo ſuddenly as would be incredible, if not clear from the moſt certain obſervations.

The noſtrils of an healthy man, that lives in an air moderately warm, ſhall not diſtil ſo much as a ſingle drop in a day; whatever therefore in this caſe exhales from the noſtrils is very ſubtle and perſpirable. But if in the evening a cold ſeize him, after having been all day in a warm air, he will ſtreight find an itching in his noſtrils followed by a ſneezing, and then a very limpid liquor ſhall begin to fall from them, and this ſhall be called a cold. In the night, whilſt he ſleeps, the internal membrane of his noſe ſhall ſwell, and cloſing up the paſſage, he ſhall not be able to breathe but through his mouth; and the next day he ſhall frequently blow out of it a large quantity of a thick mucus; this ſhall continue for many days, and ſometimes months: in ſleep he feels not the irritation of the mucus in his noſe, but in the morning ſhall find there tenacious lumps like leather formed from the inſpiſſated mucus. The ſame circumſtance ſhall likewiſe occur to the wind-pipe, the aſpera arteria, and the lungs, ſo that after ſleeping, ſuch thick pieces of concreted mucus ſhall be thrown up, that one would wonder the patient was not ſuffocated by them; and hence ariſe the ſtrugglings, toſſings, and troubleſome dreams, which ſuch perſons, as have catarrhs, labour under, and which ſeem to indicate a very difficult paſſage of the blood through the lungs.

How much therefore, and frequently, do they err, who would in this caſe attenuate the blood by ſudorificks, diureticks, &c. ſince, when the moſt liquid part is carried off, the remainder tends to concretion ſo much the more.

6. A ſound body generates a pituitous matter, which ought to be diſcharged out of the body when it has done its office; otherwiſe it will be apt to increaſe and become morbid. The internal ſurface of the wind-pipe and bronchial veſſels is intirely overſpread with a very ſmooth mucus, which covers and defends the nerves that are there diſperſed, and are ſo apt to be affected by the leaſt irritation; but in an healthy young perſon, that breathes well and is active, this mucus is diſſipated after it has done its office; or collecting in a larger quantity after ſleep, is eaſily thrown off by a little coughing and hawking. And yet in old men this mucus is gradually collected, and grows ſluggiſh and viſcid, and incapable of being thrown off by the weak action of their lungs, and ſtill weaker action of their ſides, ſo that it occaſions a kind of *ſtertor* and hiſſing noiſe in the part of the lungs where the air is lodged, 'till at length, with much coughing and trouble, it is brought up. From the conſtant ſupply of this mucus ariſing from the diminution of the concoctive powers of the lungs, the greater dilatation of its veſſels, and relaxation of the mucous cells, proceeds that aſthmatick cough incident to old men, whereof Hippocrates ſaid long ago (*c*), "that hoarſeneſſes and colds in old men did not paſs "regularly;" *raucedines & gravedines in valde ſenibus non coquuntur.* For which reaſon whatever is of uſe to attenuate this viſcid mucous matter, and at the ſame time revive the languid powers, is in this caſe more particularly ſeviceable to old men. For ſuch a collection of mucus is not only to be found in the lungs, but in the ſtomach and inteſtines, and even

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(*c*) Aphoriſm. 40. Sect. 2.

even in the bladder; for which reaſon old men ſo frequently make a pituitous urine.

## SECT. LXX.

IT ariſes firſt in the firſt inſtrument of digeſtion, then in the blood, and after this in the other liquids that are derived from it.

This viſcid gluten generated from ſuch kind of aliments will always make its firſt appearance in the ſtomach and inteſtines; and indeed ſuch glutinous matter ſeems incapable of entering the very ſmall orifices of the lacteal and meſenterick veins: ſuch particles however may ſteal in, in a ſeparate ſtate as it were, diluted with thinner liquors, and mixing with the blood by their union there form this præternatural viſcidity in the great cavities of the heart and *ſinus venoſus*, which will generally appear firſt in the lungs, becauſe the freſh chyle muſt immediately paſs through all its narrow paſſages. For which reaſon, when weak people dine upon mealy ſubſtances not well fermented, they ſhall find themſelves ſubject to a difficulty of breathing within a few hours after, from the viſcid chyle's paſſing with a greater difficulty through the lungs.

But the humours ſecreted from the blood will follow the nature of the blood, from which they are ſecreted. If the blood therefore abounds with ſuch a viſcous diſpoſition, ſo will the humours alſo that are ſecreted from it.

## SECT. LXXI.

IN the *primæ viæ* it cauſes a loſs of appetite a ſenſe of fulneſs; nauſea, vomiting; indigeſtion of the aliment; inactivity of the bile, its inviſcation and conſumption; it breeds phlegm in the ſtomach and inteſtines; occaſions a coſtiv

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and ſwelled belly; and hinders the due preparation, perfection, and ſecretion, of the chyle.

Loſs of appetite.] When the ſtomach is not able to digeſt the food, the appetite fails; and returns with the power to digeſt. But this viſcid matter is ſeldom accumulated here unleſs when the ſtomach is weak. The loſs of appetite is known to proceed from this cauſe, if it falls off ſlowly and by degrees, and at length be quite gone, without any diſeaſe foregoing, or any ſign of corruption in the humours that lie about the ſtomach. Thoſe perſons are miſerable indeed, who upon drinking ſpirituous liquors to exceſs, have at length deſtroyed the tone of their ſtomach, and loſt their appetite: theſe, when they riſe in the morning, are ſubject to a troubleſome nauſeá, and continually vomit up a thick phlegm.

Senſe of fulneſs.] It is a conſtant complaint with perſons in this caſe, that they are always full, are never hungry, and feel a perpetual load lying heavy at their ſtomach. For the ſtomach is ſo made, that when any thing contained in it is hard to be digeſted, it ſhall ſeem as though it were loaded and oppreſſed. How heavy will a little broth, if made ſtronger than ordinary, lie upon the ſtomach of a weak perſon, who has lately recovered from a diſeaſe?

Nauſea, vomiting.] This viſcid phlegm ſticking to the inſide of the mouth, or fluctuating up and down in the ſtomach, ſhall irritate it to ſuch a degree as to bring on an almoſt continual nauſea, and often a very grievous vomiting, which if the cauſe ſubſiſts, ſhall laſt a conſiderable time. It is well known, that a ſlight irritation of the fauces and ſtomach may produce nauſea and vomiting by mere mechanical motion. What an exceſſive nauſea ſhall follow from worms crawling in the ſtomach, or a feather's being thruſt down the throat! This is a diſeaſe to which learned men are ſubject in their more advanced years, who have ſometimes the inner coat of the fauces, œſophagus, and ſtomach, ſo diſpoſed, as are the membranes which line the noſtrils in a cold; inſomuch that a large quantity of mucus ſhall be diſcharged from it for ſeveral months together.

Indigeſtion of the aliment.] The food that is ſwallowed is ſo wrapped up in the tenacious phlegm, which ſometimes ſticks here, as to render the effects of the ſeveral humours flowing hither altogether fruitleſs; and yet the action of theſe, and more eſpecially of the bile, is the principal inſtrument in forming the chyle. Since therefore thoſe cauſes, which in a ſound man abſterge and divide whatever is viſcous in theſe parts, could not hinder the accumulation of it here; much leſs are they able to attenuate it after it is thus collected. For which reaſon it is, that the food, eſpecially the harder ſort, is often vomited up after it has lain many days in the ſtomach wrapped up in phlegm.

Inactivity of the bile.] It has been obſerved in the preceding paragraph, that the glutinous matter adhering in the *primæ viæ*, could not poſſibly enter the blood, unleſs diluted; but that the particles, which when united compoſed that viſcous ſubſtance, might, when ſeparated and mixed with others that were leſs viſcid, gain an eaſy admittance into the mouths of the veſſels which open into the cavities of the inteſtines. Theſe veſſels are either the lacteal or meſenterick veins. Now whatever enters the meſenterick veins is directly carried by the vena porta to the liver. But as the circulation of the humours in the liver is ſlower than in any other part, ſo the glutinous particles will more eaſily unite in the blood that flows through it; and yet from this blood it is, that both the ſorts of bile are ſecreted; and the bile particularly, which is carried into the gall-bladder, when collected and ſtagnating there, furniſhes the glutinous particles with an eaſy opportunity of uniting together. The butchers often find the gall-bladder in hogs to be greatly diſtended, and full of ſo glutinous a bile, as to admit of being drawn into threads.

Its inviſcation and conſumption.] It ſeems very probable, that after the bile has been mixed with the chyle in the inteſtines, it is abſorbed again in part by the meſenterick veins, and ſo returns to the liver; and after it has gone through the operation of that bowel, is ſecreted again, ſo that the moſt finiſhed part of the bile may go and come the ſame way ſeveral times. But when it is inviſcated with this tenacious gluten, it cannot be reſorbed by the meſeraick veins, but paſſes with it by the periſtaltick motion into the great guts. It is plain therefore, that a conſiderable quantity of the pureſt bile may thus be conſumed to no purpoſe.

Phlegm in the ſtomach and inteſtines.] *i. e.* of a morbid ſort, generated here from the cauſes already explained. And may not the ſame cauſes alſo give riſe to the phlegm, which the antients termed vitreous? It has been often obſerved, that certain ſhining lumps have been diſcharged by ſtool, that have ſhook like a jelly, and been tranſparent as the pureſt glaſs; which from their glutinous quality may ſeem to belong to this place. This ſort of vitreous phlegm has generally followed after very ſharp pains in the abdomen.

Galen ſays of himſelf (a), *Memini mihi ipſi accidiſſe dolorem vehementiſſimum, ut mihi viderer in intimo ventre terebra perforari, in illo potiſſimùm ſpatio, per quod a renibus ad veſicam ureteres ſcimus extendi; injecto deinde oleo rutaceo, quum id paulò poſt excernere tentarem, excrevi ſimul cum graviſſimo dolore humorem vitreum a Praxagora appellatum, qui vitro fuſo, tum colore, tum conſiſtentia, conſimilis eſt, atque id aliis quoque accidere conſpexi, &c. frigidiſſimus autem percipitur ſenſu tactus, tum ipſorum qui excernunt, tum ſiquis confeſtim ipſum tangere voluerit, &c. evacuato hoc humore, dolor ſedabatur*; " I remember I was once ſeized with the moſt " violent

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(a) De locis affectis, Lib. II. cap. 5. Charter. Tom. VII. pag. 405.

"violent pain, as if the innermoſt part of my belly had "been bored through with an auger, in that part chiefly where the ureters paſs from the kidneys to the "bladder: having injected ſome oil of rue, and ſoon "after trying to throw it back, together with it I "diſcharged with the moſt exceſſive pain what Praxagoras calls the vitreous humour, being both in colour and conſiſtence like melted glaſs, which circumſtance I have ſeen in others, &c. this humour "ſeems very cold both to the perſons who diſcharge "it, and alſo to the touch. if felt immediately, &c. "after this humour was diſcharged the pain left me." He owns he was miſtaken in thinking that it was occaſioned by a ſtone in the kidney. It does not ſeem probable, that this ſevere pain ſhould proceed from an inactive phlegm; this glaſſy ſort therefore ſeems different from that kind which is naturally collected.

A coſtive and ſwelled belly.] The bile ſeems to be the principal ſtimulant whereby ſtools are procured; and therefore we find, when it is too ſharp, it cauſes choleras and violent dyſenteries; if it does not paſs at all into the inteſtines, as in jaundices, it produces coſtiveneſs. But we have already obſerved, that the bile grows inactive, and is inviſcated and conſumed, from an accumulation of glutinous matter in the *primæ viæ*. The inteſtinal tube is naturally diſpoſed to be very much contracted, but when it is choaked up with phlegm in ſeveral places, the contents increaſe, whilſt the thinneſt part only paſſes through, and the thicker remains behind: through its being thus ſtuffed up, and the elaſtick air intercepted, the belly often ſwells to a monſtrous ſize, as may be ſeen in children labouring under ſuch a collection of pituitous matter, who ſhall have their little prominent bellies ſwollen to a ſurprizing degree, whilſt all the reſt of the body ſhall grow leſs for want of nouriſhment, till they look like ſkeletons. Theſe are happily cured by carrying off this foul heap of matter by proper purges, and then giving medicines which ſtrengthen, at the ſame time rubbing the belly well with aromatick ointments.

It hinders the preparation of good chyle, &c.] In order to convert the food into good chyle, we ſtand in need of the action of the ſtomach and inteſtines, together with an effuſion of both ſorts of bile, of the pancreatick juice, the *ſuccus gaſtricus*, and the liquor that is ſeparated in the glands of the inteſtines, &c. but theſe are all impeded by an adheſion of glutinous matter to theſe viſcera; for which reaſon the chyle in this caſe cannot be brought to its due perfection. Beſides, this glutinous matter will alſo ſtop up the very ſmall mouths of the lacteal and myſenterick veins, and ſo prevent the ſecrction of the chyle after it is formed in the inteſtines, by which means the body, for want of nouriſhment, will be conſumed by a true maraſmus.

## SECT. LXXII.

IN the blood it cauſes viſcidity and paleneſs, and renders it incapable of paſſing into the veſſels, through which it ought to circulate; in the veſſels it occaſions obſtructions, concretions; it produces a pale urine, with ſcarce any ſmell; viſcid ſpittle; a white ſwelling; retarded ſecretions; the deficiency of the more ſubtle liquids; and ſo a coalition of the ſmalleſt canals.

If ſuch pituitous matter, ariſing either from the glutinoſity of the food we take down, or from the natural mucus not being ſufficiently deterged, ſhall infect the blood, certain ſymptoms of ill health will follow, which when obſerved are termed the effect of a ſpontaneous gluten inhering in the blood.

Viſcidity.] This is very diſtinct from the inflammatory viſcid, as was obſerved §. 69. which does not diſſolve in water as this viſcid mucous matter does.

This has often been ſeen when a vein has been imprudently opened in perſons of this cold pituitous conſtitution; in which caſe a very little red concreted blood is found ſwimming in a large quantity of viſcid glutinous ſerum.

Paleneſs.] We may ſee the colour of the blood ſhining through the tender veſſels in all thoſe places where there is no ſkin; as in the tongue, the gums, the inſide of the mouth, the noſe, the corners of the eyes, the adnata, the inſide of the eye-lids, *&c.* when therefore all is pale in theſe places, we know that the viſcidity in the blood is not of the inflammatory but the viſcid pituitous ſort. When the blood is inflamed, and ſizy, there is a heat and redneſs in every one of theſe parts; but a paleneſs and coldneſs, in caſe the phlegm predominates. For the chyle is always white when it enters the blood, and by virtue of the circulation changes into red blood; but weak bodies, which are not able to work this change, are always pale. This is plain from the chloroſis or green-ſickneſs, to which girls are ſo much ſubject about the time of the firſt eruption of the menſes; for having attained their utmoſt growth, the ſolids and fluids being to be ballanced; mean time the chylopoitick viſcera act as before; whereby more good liquid is generated, that is, the maſs to be moved is increaſed, while the moving power remains the ſame. Hence the whole body becomes ſluggiſh, tumid, pale, not through a loſs of good blood, but becauſe more chyle is poured into it, than the powers can change into red blood. This diſeaſe always is attended with a glutinous viſcidity, as appears by the doughy ſoftneſs, the paleneſs, and ſluggiſhneſs, of the whole body.

Renders it incapable, *&c.*] For at length the viſcid blood will not paſs through the veſſels; eſpecially as the circulation is always more languid in ſuch perſons, as are of too phlegmatick a conſtitution. This incapacity of paſſing through the veſſels will ſhew itſelf principally in the ſmalleſt veſſels, in the lungs and brain; the action of theſe parts therefore will be the moſt diſordered, and conſequently ſuch perſons as are thus indiſpoſed frequently die lethargick at laſt, or are choaked by an oppreſſion of the lungs.

Obſtructions in the veſſels.] Which are much more frequently cauſed indeed by an inflammatory viſcidity, and yet proceed from a cold pituita. As certain portions of the fluid in this caſe cohere in too viſcous a manner, nor can the action of the veſſels divide them ſo minutely as is required for their paſſing through the very ſmall paſſages of the capillary veſſels.

Concretions.] Wherever the pituita ſtagnates, it will coagulate into denſe maſſes reſembling leather; eſpecially if the more liquid parts fly off, as we ſee in the mucus of the noſe. Such concretions are oftentimes thrown up from the fauces, and ſometimes from the lungs, as we daily ſee.

Pale urine with ſcarce any ſmell.] This circumſtance always ſhews the powers of the body to be languid; the urine therefore is conſtantly pale in children, lax women, and feeble old men. The ſtronger a man is, ſo much the more colour and ſmell *cæteris paribus* will his urine have. And indeed this ſpontaneous gluten is ſeldom bred in perſons that are ſtrong; for as in theſe the bile is ſharper, and the action of the viſcera more powerful, ſo whatever is viſcous in them is by this means attenuated; and conſequently this diſeaſe is uſually incident to weak people.

Viſcid ſpittle.] The ſpittle has ſome degree of viſcidity even in the ſoundeſt; and chiefly becauſe the mucus of the mouth and neighbouring parts is mixed with it. But as the liquids follow the nature of the blood from whence they are ſecreted, it is no wonder that a ſaliva more than ordinarily viſcid ſhould be ſecreted from too viſcid blood; this ſpittle mixed with the food in chewing, and ſwallowed down into the ſtomach, augments the viſcidity in the firſt office of digeſtion.

White ſwelling.] The antients called the *pituita* λεύκον φλέγμα, and for this reaſon gave this diſeaſe the name of λευκοφλεγματία. In this caſe the blood is degenerated into ſo bad a ſtate, as to loſe both its redneſs and conſiſtence, to grow lighter, become more lax, and acquire almoſt a cold muçous nature. It is called alſo ſometimes by the ſame name, when the blood becomes thin as water, and diſtends the parts under the ſkin with an hydropical tumour; but the Antients called it then more properly a dropſy ἀνὰ σάρκα. Theſe two diſeaſes are evidently diſtinct, though often confounded; for in a *leucophlegmatia* the humours are of a cold pituitous nature, in a dropſy quite watery and thin. An *anaſarca* generally begins in the lower parts, and as it increaſes the tumour aſcends; in a *leucophlegmatia* the pituita is more equally diffuſed over the whole habit: whence that laxity and doughy ſoftneſs of the whole body, attended with a pellucidneſs not unlike to ſilk-worms. Hence Hippocrates diſtinguiſhing them ſays (*a*), *quum pituita alba corpus ditinuerit, totum corpus tumore albo intumeſcit, &c. ſi curatus fuerit inchoante morbo, convaleſcit; ſin minus, in hydropem tranſit morbus, & hominem perimit*; "when white pituita has ſeized upon the body, the "whole body ſwells with a white tumour, *&c.* if it "is carried off in the beginning, the man recovers; "otherwiſe it will turn to a dropſy and kill him:" and elſewhere (*b*), *albæ pituitæ hydrops ſupervenit*; "a "dropſy follows the white pituita."

The ſecretions interrupted.] All ſecretions are made from the blood. In order therefore that theſe be performed in due manner, it is neceſſary that the blood ſhould be good. But though weak bodies can convert the aliment into chyle and milk, they cannot turn it into ſolid red blood without great difficulty; for which reaſon it is they have ſo white an aſpect. If their powers increaſe, the humours are more changed, though the change is not compleatly wrought; in this ſtate they look yellow or greeniſh, as we ſee in a chlo-

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(*a*) De affectionibus, cap. 5. Charter. Tom. VII. pag. 625.
(*b*) Aphor. 74. Sect. 7.

a chloroſis. For the ſame reaſon they ſcarcely perſpire at all, make little urine, ſecrete but little bile, &c. as the accumulated pituita either ſtops up the ſmaller ſecreting veſſels, or by diſtending the parts compreſſes them, and ſo interrupts the ſecretion.

The deficiency of the moſt ſubtle fluids.] It is plain to be ſeen in leucophlegmatick people, that all the functions are languid or quite fail, that depend on the motion of the fineſt and moſt ſubtle liquid, which paſſes through the ſmalleſt veſſels. Hence that ſlowneſs to all muſcular motion, that torpor, dulneſs of the ſenſes, forgetfulneſs, and ſleepineſs, obſervable in this caſe. For by the wiſe appointment of nature, the blood that goes to the brain ſeems to be cleared of its more viſcid and leſs moveable part, by being firſt conveyed in the external carotid to the noſtrils, the tongue, the inſide of the mouth, &c. and there depoſiting ſo large a quantity of viſcid mucus, by which means the pureſt and moſt ſolid blood is carried to the cerebrum and cerebellum for the ſecretion of the animal ſpirits. When therefore the blood degenerates into a pituitous inactive ſtate, the due ſecretion of the ſpirits fails, and conſequently all the actions that depend upon it.

The coalition of the ſmalleſt canals.] We are certain, that even the large veſſels may collapſe and grow together, if deprived of their circulating fluid. The arterial blood, which lies between the pulmonary artery and the aorta, and is ſo large in a fœtus, grows together after the birth; when the unfolding of the lungs gives a free paſſage to the blood through the pulmonary artery; by which means it flows this way no more, and the ſides of the canal collapſe, and unite very ſoon. Now if this be the caſe in ſo large a veſſel, how much more will it happen in veſſels that are ſmall beyond all imagination, when deprived of the very ſubtle liquid that paſſed through them? In this diſeaſe it is plain from what we have already ſaid, that moſt ſubtle part is wanting which ſhould keep them open; and from this cauſe it is, that after an apoplexy or palſy ariſing from this glutinous cachochymy, incurable evils are ſo often left remaining.

## SECT. LXXIII.

HENCE all the concoctions, circulations, ſecretions, excretions, all the vital, natural, and animal, motions are diſordered, whence ariſe ſuffocation and death.

The ſeveral particles here mentioned do all depend upon the due motion of the liquids through veſſels of a due ſtrength. When therefore the too great glutinoſity of the blood hinders it from paſſing freely through the ſmaller veſſels, or indeed from paſſing at all, theſe miſchiefs will neceſſarily follow. This will clearly appear by conſidering the ſymptoms diſcernible in a chloroſis.

For in this diſeaſe there is either no concoction of the aliments, or at leaſt a very depraved one, and the tendency to ſpontaneous corruption is univerſal. Hence proceed ſour and fetid belchings, *&c.* this circulation of the humours is quite diſordered, as appears by the pulſe, which is generally irregular in this diſeaſe, and the cold the conſequence of a diminiſhed circulation. The ſecretions in general almoſt all vary from the natural rule, as appears from the viſcid ſpittle, the inactive bile, and the want of ſpirits. The excretions are entirely changed; the urine pale, frothy, with ſcarce any ſmell; the belly generally coſtive; ſcarce any perſpiration. The vital motions are entirely diſordered; as appears by the difficulty of breathing, and the panting at every the leaſt motion, the enormous palpitations of the heart oftentimes, the ſwoonings, upon every the ſlighteſt occaſion; the ſlow low pulſe whilſt ſitting ſtill; and the quick and unequal one in caſe of motion; the natural functions are entirely depraved; the appetite either quite gone, or a præternatural longing for every extravagant thing, ſuch as ſand, lime, chalk, *&c.* which girls in this diſeaſe ſo often ſwallow down in private, from whence frequently ariſe moſt miſerable diſeaſes. Oppreſſed by eating, and yet the body not repaired. The animal functions alſo are entirely languid; they can ſcarce drag along their feeble limbs, and are preſently tired with every the leaſt motion; add to theſe a dulneſs of all the ſenſes, ſtupidity, and a moſt troubleſome giddineſs. At length the blood not being able to paſs through the lungs by reaſon of its viſcoſity, they are either ſuffocated, or die of a lethargy for want of ſpirits.

## SECT. LXXIV.

FROM hence (69, 70, 71, 72, 73) the diagnoſis, prognoſis and anamneſis, of this diſeaſe appear, nor is it difficult to ſee what the cure indicates.

The diagnoſis.] Which ſhews when the diſeaſe deſcribed is preſent, is eaſily to be learned from what has already been ſaid. If there be a weakneſs of the ſolids, a want of good blood, if the diet has been of that kind in which this gluten prevails, if the manner of life be ſedentary, and the appetite begins to fail, without a fever, or thirſt, or any mark of putrefaction, if the pulſe be weak, and all theſe ſymptoms be attended with a ſenſe of coldneſs, we may then certainly conclude, that a cold pituita predominates.

The prognoſis.] All thoſe bad circumſtances ſhould be here reckoned up as prognoſticks, that were enumerated §. 71, 72, 73. From the ſame principles alſo is to be had the anamneſis of this diſeaſe when paſt.

The cure.] This alſo is to be deduced from the ſame obſervations, to wit, by avoiding the cauſes mentioned in §. 69. for by this means the production of a viſcidity may be prevented; or if it is already produced, it muſt be attenuated by proper remedies, that it may not henceforward do any farther miſchief.

## SECT. LXXV.

WHICH will be obtained, 1. by the uſe of meat and drink well fermented, ſeaſoned with ſalt and aromatick ingredients; 2. by broths made from the fleſh of birds; 3. by ſtrengthening the veſſels and viſcera; 4. by an increaſe of motion; 5. by medicines that dilute, reſolve, ſtimulate, and are of the bilious and ſoapy kinds; 6. by friction, heat, baths, bliſters. But beſides this the inner parts of the body are liable to glutinous or thick concretions of ſundry other kinds, ſuch as caſeous, mucous, mucilaginous, friable, ceraceous, pultaceous, dreggy, calculous, tartareous, inflammatory ſerous, polypous, meliceratous, ſteatomatous, denſe atheromatous, ſchirrous concretions. And a Phyſician ought to be extremely careful that he do not expel together with the morbid gluten that benign, natural, lubricating, unctuous, defenſive, glutinous matter, which nature has for neceſſary uſes placed in the eyes, eye-lids, noſe, mouth, fauces, gullet, ſtomach, inteſtines, pelvis, ureters, bladder, urethra, in the mucilaginous ſheaths of the tendons, in the articulations of the joints, in the larynx, aſpera arteria, and bronchia, which has too often happened by the fatal miſtake of ignorant men and quacks.

1. Flower mixed with water becomes a viſcid ductile paſte; ferment this paſte, and whatever is tenacious in it is divided, and ſo much the more as the fermentation is longer and greater. Bread well fermented therefore is proper here, eſpecially biſcuit; for this melts of itſelf if you eat it; eſpecially ſeaſoned with a very little ſalt and the agreeable ſpices mentioned in the *materia medica*.

For drink, wine, or ſtrong beer, which is poſſibly preferable to wine in this caſe. Where the gluten is inflammatory, we give a very ſmooth decoction of barley, which would increaſe the viſcidity we are now treating of. Of the ſame barley differently managed is made beer, a noble remedy in a cold glutinous degenerated ſtate of the blood, and of the humours ſecreted from it. For this purpoſe the barley is ſteeped in water till it ſwells and begins to ſprout, it is then ſpread on a floor and turned twice a day till moſt part of its moiſture is gone; it is next dried on a kiln and called malt, which after being ground is infuſed for ſome hours in water, that is poured upon it boiling hot. This water enriched with very near the whole ſubſtance of the barley diſſolved, is boiled in another veſſel, and then being fermented produces beer; which retains its ſpirits in ſtronger bonds as it were than wine, and for this reaſon its effects in the body are moſt laſting. This beer, of the ſtronger ſort eſpecially, is a moſt noble remedy: and Brunſwick mum with biſcuit has often cured diſeaſes of this kind without the application of any other remedies.

2. For theſe broths have not ſo much of the tenacious gelatinous part, but as ſoon as they are ſwallowed, are by the heat of the body in a manner diſpoſed to putrefy, eſpecially if made of the fleſh of little birds that live on inſects, by which means their fleſh is more inclined to putrefaction than that of animals which have been fed with graſs; and beſides they are ſeaſoned with ſpicy ingredients: for putrefaction, through

though but beginning, attenuates whatever is viſcid; thus the thickeſt jelly of hartſhorn, from the moment it begins to putrefy, ſhall become as liquid as water.

3. We have already given directions how the veſſels and viſcera are to be ſtrengthened §. 47. and we daily ſee robuſt country people digeſting the hardeſt fare, ſuch as potatoes, unfermented mealy food, fleſh hardened with ſmoke and ſalt, without difficulty, which would produce the moſt obſtinate obſtructions in the viſcera of weak perſons.

4. It is a vain attempt to cure a perſon labouring under this pituitous indiſpoſition by food and phyſick, unleſs you can prevail upon him to caſt off that ſluggiſhneſs which is natural to this diſeaſe, and to exexeriſe himſelf almoſt beyond his ſtrength. And yet the motion muſt not be too violent at firſt, leſt this mucous matter ſhould be thereby thrown upon the lungs, which could not be without very great danger: this often happens, when the glutinous matter collected in the winter is ſuddenly liquified by the heat of the ſpring, and mixing with the blood, is ſtopped in its paſſage through the very minute veſſels of the lungs, by which means the patient is ſuffocated at once; but the motion muſt be gentle in the beginning, and increaſed by degrees; and if the body is too weak to uſe exerciſe, friction ſhould ſupply its place.

5. By diluting medicines.] Water is the only proper diluent, and whatever other medicines are called diluents, act only on account of the water they contain. That cold pituitous matter we here treat of may be diluted and diſſolved in water, eſpecially if warm; but this is a momentary relief only, for by weakening the ſolids it would increaſe the cauſe of the diſeaſe. This is that deceitful relief, that men given up to ſtudy, and labouring under a load of phlegm, feel by drinking warm watery potions; though in the end it frequently proves their deſtruction. Such diluents therefore are only good in caſes

where it is required ſpeedily to dilute the pituita, that is, whilſt it is ſtill ſtuctuating in the ſtomach.

By reſolvents.] Theſe have been treated of §. 54. numb. 4. where alſo we ſpoke of diluents.

Stimulants.] Every thing that, when applied to the body, increaſes the motion of it, may be called a ſtimulant, this being the common effect of all ſtimulating medicines however they act. Some of them appear to act by the figure and rigidity of their particles, which having ſharp points, and being driven by the courſe of circulation againſt the ſides of the veſſels, cauſe them to contract the quicker by means of this irritation. But for the greateſt part of them, though we clearly ſee their effects, yet we do not ſo eaſily diſcern in what manner they act upon our bodies. Cinnamon, for inſtance, excites the languid powers by a moſt agreeable and efficacious ſtimulus; and yet that which gives the cinnamon this virtue is incredibly minute, and when freed from the oily part, wherein it is wrapt up, eſcapes the notice of our ſenſes. Whatever this virtue is, it all enters into the oil, that is obtained from cinnamon by diſtillation, and yet if this oil be expoſed to the open air for ſome few days it will loſe all its virtue without any ſenſible loſs of weight. Now who ſhall point out the figure of this moſt ſubtle part, wherein the ſtimulating virtue of the cinnamon reſides? So in poiſons, what terrible diſorders do their ſtimulating particles create in the whole corporal ſyſtem? What violent commotions do they raiſe? In the ſmall-pox, meaſles, plague, *&c.* with what prodigious power does the poiſon act? And yet here alſo the minuteneſs of the ſtimulating particles eludes our enquiry; their power is known only by their effects.

But the affections of the mind alſo, which are only a change of the thoughts, work ſurprizing alterations in the body, and are capable of raiſing violent fevers, of increaſing, diminiſhing, and diſordering, both all the ſecretions and excretions.

The effect therefore of ſtimulants does not always depend upon the figure, weight, and ſtiffneſs, of their particles. And it ſuffices for the Phyſician's purpoſe, that he knows what particulars applied to the body ſhall increaſe its motion, though he does not know the manner whereby they act.

Theſe however all ſeem to act by exciting greater motion and heat, and ſo in their laſt effect dividing the glutinous matter, and changing it in ſuch manner by this means, as to make it obtain the nature of the ſound humours.

For that the blood, when oppreſſed with a pituitous load, may by the action of the veſſels on the liquids they contain, thus acquire every property required to ſanity, is clear from the moſt certain obſervations.

A weakly girl labours under a chloroſis, her whole
body is puffed up with a lax œdematous ſwelling,
every part about her is pale and cold. Let her firſ
take a gentle vomit or purge of Pill. Ruffi. or ſom
ſuch like medicine, to carry down the mucous loa
that is lodged in the *primæ viæ*, that it may not pre
vent the efficacy of other medicines; and then giv
a medicated wine made of aromatick ingredients an
filings of ſteel; and you will find that by the uſe o
theſe a greater heat and a kind of ſlight fever will a
it were kindle in her body; the lax humour in all th
parts will begin to ſubſide, and the agreeable re
ſhew itſelf in the lips, gums, and ſkin; and withou
any evacuation of the predominating viſcid, the ſoli
red blood will return again, and the functions be re
ſtored to their perfect ſoundneſs.

It was certainly very prudent advice in Gale
when he ſaid (a), *pituita autem frigida & humida eſt,*
*veluti quoddam ſemicoctum alimentum; quare non*
*evacuanda, ſed debet in corpore manere atque altera*
(ἀλλοιοῦσθαι) " that the pituita is cold and moiſt, a ſo

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(a) In librum Hippocr. de alimento Comment. III. Charte
Tom. VI. pag. 255.

“ of half concocted aliment; and therefore it is not “ to be evacuated, but retained in the body and al“ tered.”

In the *materia medica* you have theſe ſtimulants enumerated according to their various claſſes.

By bilious medicines.] The bile and phlegm are of ſo oppoſite a nature, that they can never predominate together; bile being the greateſt detergent, diſſolvent, and attenuant, of all pituitous matter. If the bile be hindered from flowing into the duodenum, and by this means be thrown back into the blood, it diſſolves it to ſuch a degree, that after a long jaundice there uſually follows a dropſy. Wherever this viſcid pituitous matter is accumulated, the bile is either deficient in quantity, or it is too inactive. Nothing therefore ſeems more proper in this caſe than to ſupply the defect of the bile, either by giving the bile of ſome other animal, or by the uſe of bitter plants, ſuch as wormwood, centaury, *&c.* The former ſeems the moſt natural method, and for this reaſon the bile of the moſt voracious animals that uſe no manducation, nor have ſeveral of the other aids of digeſtion, has been choſen principally for this purpoſe; as in theſe a ſharper bile than ordinary ſeems to have ſupplied the want of the other. Thus the gall of a jack that devours fiſhes whole, and of eels, has been much commended for this purpoſe. Zoographers obſerve, that the fierceſt animals have the moſt acrid bile, and for this reaſon the Apothecaries keep in their ſhops the gall of bulls inſpiſſated. And perhaps that moſt coſtly porcupine-ſtone, called *Pedro del Porco*, may owe its virtue as well as its origin to bile.

Soapy.] The Venetian ſoap has been chiefly commended as the moſt mild diſſolvent of all glutinous fat ſubſtances. To this Phyſicians add about one twentieth part of gall, and give it in pills; and thus endeavour to ſupply the defect of the natural bile. For the hepatick bile is never bitter, but perfectly ſaponaceous, and ſufficiently reſembles the Venetian ſoap. The cyſtick bile flows out in very ſmall quantity by reaſon of the narrowneſs, intorſion, and ſituation, of the neck of the bladder. Thus art endeavours to imitate nature.

6. By friction.] What the effects of friction are has already been ſhewn §. 28, numb. 2. Children, whoſe bellies ſwell through theſe glutinous obſtructions, are greatly relieved by having them rubbed with rough cloths: this ſhould be done in a morning after ſleep, and faſting; for when the ſtomach is full they cannot eaſily bear it. Nay Galen would not admit that any friction at all ſhould be uſed to the belly (*a*); *quam alioqui periculum ſit, ne & cibum deterius concoquat, & ſuccus quiſpiam ex eo ſemicrudus in corpus digeratur, & caput turbetur, & ſtomachus ſubvertatur*; "fearing leſt by this means the food ſhould be "worſe concocted, or ſome half-crude juices be "thereby thrown into the body, the head diſordered, "and the ſtomach ſubverted." But if the friction be uſed whilſt the ſtomach is empty, there is no danger of any of theſe conſequences.

Heat.] All the medicines which are judged ſerviceable in the cure of glutinous diſeaſes, are generally ſuch as occaſion a greater heat in the body. But heat excited by muſcular motion will be more eſpecially beneficial here, becauſe it ſtrengthens too. Nor will the loſs of humidity in this caſe be of any prejudice, ſince in theſe diſeaſes there is generally too large a quantity of moiſture.

Baths.] Theſe are either wet or dry. The former act by relaxing and diluting. To theſe therefore are added aromatick herbs, which ſtrengthen and attenuate, and at the ſame time frictions are uſed: afterward the dry baths are of ſervice by exciting a greater heat. But as the whole external ſurface of the body is covered over with bibulous veins, the virtue of theſe aromatick herbs

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(*a*) De ſanitate tuenda, Lib. III. cap. ult. in fine. Charter. Tom. VI. pag. 114.

herbs may be tranſmitted through them, eſpecially when they are relaxed in the bath.

Veſicatories.] So are thoſe remedies called, which when applied to the ſkin, lift up the epidermis into a bladder full of a thin ichor. They are made of the moſt acrid plants, ſuch as horſe-raddiſh, muſtard, the ranunculi, *&c.* or moſt commonly cantharides. Theſe act by raiſing an heat in the part to which they are applied, and thence diffuſing it over the whole body. When they are imprudently applied, and eſpecially the cantharides, they cauſe a fever, thirſt, a burning heat, a cadaverous ſmell, and a moſt troubleſome ſtrangury; wherefore Dioſcorides reckons them among the poiſons. Theſe all act as ſtimulants, whereby they excite the languid motion of the blood, and by their diſſolving power, whereby they divide and attenuate the pituitous matter, for which reaſon it is, that they prove ſo ſerviceable in all languid and cold diſeaſes. But where the humours are diſſolved, acrid, inclined to putrefy, and are thrown into any violent motion at the ſame time, there the uſe of them does not not ſeem to be altogether ſo ſafe.

But beſides this, the inner parts of the body are liable to, *&c.*] We learn from medical obſervations, that ſtrange concretions of the humours may happen in various parts of the body, and of a quite different nature from each other, which ſhall interrupt the action of the parts where they are ſeated, and to be the cauſe of very wonderful and obſcure diſeaſes. The principal claſſes of theſe concretions are here enumerated.

Glutinous or thick, *&c.*] We have ſhewn through the whole of this chapter, that ſuch ſubſtances may be produced in the body, partly from the reſembling nature of the aliment, and partly from the accumulation of the natural gluten.

Caſeous.] Cheeſe is the produce of milk only, for the chyle has it not; by adding the coagulum the milk ſeparates into two parts, *i. e.* a thin whey and a thick curd, which when the whey is all expreſſed forms cheeſe; this when dried will often become hard as horn, and even like the horns of animals will grow ductile by being expoſed to the fire, and in diſtillation yields a volatile alcaline ſalt. And yet the milk containing this cheeſe, which is capable of aſſuming ſo great a degree of hardneſs, was carried with the blood through all the narrow paſſages of the lungs; if therefore, by any accident, ſuch a ſeparation of the milk into whey and curd ſhould happen as it moves in the veſſels, what numberleſs diſorders might ariſe from it? If the milk ſtagnates and corrupts in the lactiferous ducts of the breaſts, the thin whey drops off by the nipple, whilſt the curd which is left behind occaſions inflammations, ſuppurations, ſchirrhus's, and frequently cancers. There was found a tumour in the abdomen of a young gentleman, containing ſeven pounds and a half of white matter, which was partly fluid like milk and in part caſeous (*c*).

Mucous.] In all the places that are covered by the Schneiderian membrane, which is the proper ſeat where the mucus is formed, we learn from daily obſervation, that mucus may be produced, accumulated, and often grow into ſuch maſſes as are not eaſily afterwards to be diſſolved. But it ſeems ſtill more ſurprizing, that a mucus ſhould be formed in ſuch places, as by their natural ſtructure are ſet apart only for the ſecretion of the moſt ſubtle humour: for ſuch a mucus has been found in the very ventricles of the brain, and been the occaſion of a cold apoplexy (*d*).

Mucilaginous.] The Haverſian glands, ſo called from Havers, who firſt deſcribed them, are plainly to be ſeen in the joints, and more eſpecially in the larger ones, which ſecrete a mucilaginous ſlime that ſerves to lubricate the receiving and received bones, and the inner ſurface of the ligament that ſurrounds the

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(*c*) Acad. des Sciences, l'an. 1729. Hiſt. pag. 17, 19.

(*d*) Theoph. Boneti Sepulchr. Lib. I. pag. 103, 104, 105, 108, 131, &c.

the articulation. This mucilage either growing too thick, or becoming accumulated through want of moving the joint, will often occaſion ſtrange tumours about the joint, and ſometimes bring on an incurable anchyloſis.

Friable.] The eyes of an healthy perſon, being overſpread with a moſt ſubtle lymph, do naturally ſhine; but if the leaſt diſorder happens here, this liquid will be plentifully ſecreted and fall down in a larger quantity, and then there ſhall appear a thick viſcous mucus cloſely adhering to the adjoining parts, and deforming the beauty of the eye. This glutinous matter ſhall become ſtill thicker, and form little maſſes called *lemæ*, which in a few hours time ſhall be collected in the greater angle of the eye, and be abſolutely friable. And thus ſhall a hard friable ſubſtance be produced within a few hours from a moſt limpid humour ſecreted from the pureſt blood.

Ceraceous.] We learn from a ſtrange caſe, which has once happened, that the humours of the eye, which in health are ſo limpid and pure, are capable of being converted into a ſubſtance reſembling tallow. For upon the extirpation and diſſection of an eye, that had hung out a conſiderable way beyond the eyelids, and was extirpated to avoid worſe conſequences, all the humours in it were found to be thus changed (*e*). And if ſuch an alteration could be wrought in the eye, what may not poſſibly happen in the other parts of the body? Such a ceraceous matter naturally reſides, pent up in its proper cyſts, in the wrinkles of the anus, which when inſpiſſated and accumulated may give riſe to tumours of this nature (*f*).

Pappy.] Severinus found ſuch a kind of matter in ſeveral abſceſſes (*g*). And it ſeems highly probable, that ſomething of a reſembling nature may have been obſerved in the internal parts.

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(*e*) Theoph. Boneti Sepulch. Lib. I. pag. 427, 428.
(*f*) H. Boërhaave Epiſt. Anatom. ad Fred. Ruyſch. pag. 11.
(*g*) De Recondita Abſceſſ. Natura. pag. 183.

Dreggy.] The liver, when inflamed, like all other parts of the body, will ſometimes ſuppurate, and this friable bowel, when quite conſumed, will not turn to good pus, but inſtead thereof a corrupted matter, not unlike dregs, ſhall paſs off by ſtool; or in caſe the abſceſs points outwardly, upon the rupture or cutting of the integuments, a like matter ſhall be diſcharged; whence Hippocrates obſerves (*h*), that in caſe of a dreggy diſcharge from a ſuppuration in the liver, the diſeaſe is mortal.

A tumour has been found in the abdomen under the peritonæum full of ſtinking matter, like the lees of red wine both in colour and conſiſtence, amounting in quantity to about twelve pints (*i*).

Severinus found a reſembling ſubſtance upon opening a tumour in the left knee (*k*).

Calculous.] That ſtony ſubſtances are generated in the body is unqueſtionable, eſpecially in the urinary paſſages, the kidneys, ureters, bladder, and about the liver; in which places the humours ſtagnate, as i were, in larger cavities, or move very ſlowly, at leaſ in the liver: ſo that calculous concretions may the more eaſily be conceived to happen in them. But i is more wonderful, that a ſtone ſhould be found in the ſubſtance of the heart, which is never at reſt (*l*) as alſo in the cavity of the belly fixed to no particular part (*m*); as alſo, that the brain of a very ſtron ox, which four times eſcaped out of the hands of th butchers before he could be killed, ſhould be found a over ſtony (*n*).

Tartareous.] So are thoſe calculous concretions called, which cover the whole ſurface of any particula part with a ſtony cruſt-like tartar. The placenta ſometimes covered with ſuch a cruſt, and the du

mate

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(*h*) Coacar. No. 451. & Aphor. 45. Sect. 7. (*i*) Peyer. Parer Anatom. pag. 191. (*k*) De Recond. Abſceſſuum Natur. pag. 15

(*l*) Philoſph. Tranſact. abridged, Vol. III. pag. 158.

(*m*) Acad. des Sciences, l'an. 1703. Hiſt. pag 46.

(*n*) Id. l'an. 1703. Mem. pag. 315.

mater of the brain has been found to be incruſtated with a like ſtony matter (*o*).

Serous inflammatory.] This appears in pleuritick blood, which has the globular part of it covered with a thick ſkin like leather, that can ſcarce be cut through with a penknife, formed from the condenſation of the ſerum: for the blood is naturally prone to concretion, and this diſpoſition is conſiderably increaſed in all inflammatory diſeaſes.

Polypous.] Of this ſort, §. 52. numb. 2.

Meliceratous, ſteatomatous, atheromatous.] Theſe differ only as to the various conſiſtence of the matter they contain. Galen in his treatiſe of præternatural tumours, cap. 5. ſays, that an atheroma contains a ſubſtance reſembling ſoap; the mileceris a ſubſtance like honey; and the ſteatoma a ſubſtance like ſuet. Theſe are generally contained within a kind of a membranous coat (*p*). In the external ſkin, if the duct be obſtructed, the ſcales will riſe by the addition of new matter, that is not carried off, and produce a tumour of this ſort. We learn alſo from the obſervations made by Phyſicians, that the ſame circumſtance may happen to the internal parts. A ſteatoma formed between the cerebrum and cerebellum to the ſize of a man's fiſt, has firſt cauſed blindneſs, and afterwards ended in death (*q*). A true ſteatoma weighing more than ſix pounds has been found in the cavity of the breaſt, which has at laſt after exquiſite miſery killed the patient (*r*).

Schirrhous concretions.] A perfect ſchirrhus is defined by Galen (*s*) to be a præternatural tumour without ſenſe and hard. Such a tumour is often left after inflammations ill cured, eſpecially in the glandular parts. Innumerable obſervations might be quoted from the practical

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(*o*) Theoph. Boneti Sepulchr. Lib. I. pag. 59. (*p*) Dictionar. Medic. ex Hippocrat. Aretæo, &c. pag. 465. (*q*) Theoph. Bonet. Sepulchr. pag. 422. (*r*) H. Boërhaave atrocis & rariſſimi morbi Hiſtoria altera. (*s*) Method. Med. ad Glaucon. Lib. II. cap. 6. Charter. Tom. X. pag. 378.

practical writers to ſhew, that all the viſcera have at ſome times become ſchirrhous.

A Phyſician ought to be extremely careful that he do not expel that benign natural gluten, &c.] This advice is of the greateſt conſequence, as the neglect of it has given occaſion to ſcandalous miſtakes. For many have been of opinion, becauſe life and health ſeemed only to conſiſt in the free courſe of the fluids through the veſſels, that the liquids could never be too thin, and that whatever was thick or tenacious was to be reckoned morbid. They, who have thoroughly examined the fabrick and uſe of the parts, have diſcovered very plainly, that a viſcid mucus is ſecreted in many parts of the body by proper organs for certain neceſſary uſes. If the edge of the eye-lids, which are ſo often rubbed againſt each other, were not defended with ſuch a ſoft wax, they would ſoon be inflamed and excoriated; as appears by thoſe moſt troubleſome ſoreneſſes, which ſo frequently happen from the want of it. If the nerves, that are diſperſed through the large cavities of the noſtrils, were not covered over with mucus, they would ſoon grow dry by being expoſed to the air, and the ſenſe of ſmelling be loſt. All the parts within the inſide of the mouth, the fauces, œſophagus, are covered with a like liniment, that what is to be ſwallowed may paſs the more eaſily over parts already lubricated. The internal ſurface of the ſtomach and inteſtines, even in the ſoundeſt animals that are ſlain, appears to be very much lubricated, and overſpread with a reſembling mucus, that the extremities of the veſſels and nerves, which here lie open and prominent, may be defended from the acrimony or aſperity of the aliment; ſo that when it is rubbed off in a dyſentery, the want of it cauſes moſt exceſſive pains, which are only to be aſſwaged with ſuch remedies as are capable of ſupplying its defect by their gluten. All the paſſages through which the acrid urine paſſes are lined with ſuch a mucus; which if it be wanting in a certain part of the urethra, will occaſion a moſt troubleſome ſtrangury to enſue, that may notwithſtanding be happily cured by the uſe of the mucilaginous decoction of marſh-mallows. The tendons are ſurrounded with mucilaginous ſheaths, that they may move in a more eaſy manner, and in caſe theſe ſheaths are deſtroyed by means of a ſuppuration or gangrene, they are no longer capable of being moved at all.

The extremities of the bones in the joints are ſpread over with a thin mucilaginous matter; and in caſe this fails by any accident, through violent or long continued motion, through diſeaſes or old age, a ſnapping and pain in the joints will always follow. The internal ſurface of the larynx, the aſpera arteria, and the whole airy cavity of the lungs, has nerves ſo irritable, that if they were not covered with a mucus, the contact of the air would occaſion a perpetual coughing.

Since then there is a mucus naturally belonging to all theſe ſeveral parts, it is not rightly judged to be morbid, and for this reaſon when thrown out of the body is followed by very ill effects. The internal uſe of cantharides has often been attended with the diſcharge of a bloody mucus expreſſed in a ſmall quantity, but followed by a cruel ſtrangury, the urinary paſſages being as it were ſcraped bare by the virulent acrimony of theſe inſects. Sharp purges after a great many ſtools ſhall frequently bring away a ſmall quantity of yellowiſh gluten ſtreaked with blood, and be followed with a violent teneſmus and pain; this is no more than an abraſion of that benign gluten, which lines the inteſtines, and is ſucceeded by moſt exquiſite pains ariſing from their being excoriated. And thus of every other part.

# The DISEASES from a ſpontaneous alcaline CAUSE.

## SECT. LXXVI.

THERE are ſome plants abounding with a ſort of matter, which when it corrupts of itſelf does not become acid or viſcid, but is reſolved into a fetid, volatile, fat, alcali: ſuch are almoſt all the aromatick plants that are very ſharp to the taſte. But theſe are ſeldom taken in ſuch a quantity, as to cauſe a diſeaſe of themſelves. But if this ſhould happen, it ought to be aſſigned to an acid oleoſe alcali.

Alcali is a name now received in the art, and ſeems to be derived from a very ſalt herb called *Kali*, which when ſet on fire will leave behind it aſhes, that are plentifully ſtored with an acrid ſalt. Many plants burnt in an open fire will produce aſhes that are more or leſs ſalt: theſe aſhes boiled in water will yield a ſaline lixivium, which upon evaporation ſhall leave behind the ſalt called alcaline. This is to be diſtinguiſhed by certain marks (*a*): it remains fixed in the fire a conſiderable time, but becomes liquid entirely if expoſed to a moiſt air; it has a ſharp, fiery, urinous, taſte, but no ſmell; when mixed with acids it raiſes an effervеſcence, and turns the blue ſyrup of violets green, *&c.*

This ſalt drawn from vegetables by a ſtrong fire in the open air can never be produced naturally in the body; but may be thrown into it from without.

When vegetables are burnt in an open fire, a ſmoke riſes, which ſtriking to the ſides of the chimney, appears,

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(*a*) H. Boërhaave Chem. Tom. I. pag. 765.

appears in the form of a black ſhining matter called ſoot. This when diſtilled will yield a conſiderable quantity of ſalt adhering to the ſides of the receiver; this ſalt affects the tongue with an urinous taſte, like a fixed alcaline ſalt, raiſes an effervеſcence with acids in the ſame manner, and changes the colour of the ſyrup of violets; for theſe qualities it is juſtly called an alcaline ſalt, and eaſily moveable by the leaſt action of the fire.

The parts of animals, tried in the fire, have, when diſtilled, yielded a like volatile alcaline ſalt.

Putrefaction, ſo far as we have hitherto been able to diſcover, moſt certainly reduces the bodies of animals and vegetables to ſuch a ſtate, that their ſaline principle ſhall become a volatile alcali (*b*).

This volatile alcaline ſalt is to be found prepared by the natural ſtructure of the plant, requiring no art to make itſelf ſeen. Muſtard-ſeed, which if you bruiſe it, preſently exhales this volatile alcaline ſmell; if pounded with vinegar, ſhews the ſigns of effervеſcence; and yields immediately in the firſt diſtillation a volatile alcaline ſalt.

There are other plants, in which the marks of a preſent alcali are leſs clear, which yet when left to themſelves corrupt into a volatile fetid fat alcali; of theſe you have a catalogue in the *materia medica*.

The origin of an alcali in the body is either from our humours growing putrid of themſelves; or from the aliments being of a diſpoſition inclined to putrefy; or laſtly, from alcaline ſalts taken in.

But alcaline ſalts are ſeldom taken in ſo large a quantity as to be capable of doing much miſchief.

Nor are the acrid aromatick herbs mentioned in this paragraph apt to be ſwallowed in ſuch quantities, as to be capable of being the cauſe of producing a ſpontaneous alcali in the body. And yet it has ſometimes happened, that the blood has been ſo diſſolved by

(*b*) H. Boërhaave Chem. Tom. I. pag. 803.

by the imprudent uſe of them in the ſcurvy, (for they are almoſt all of them called antiſcorbuticks) and the veſſels ſo eroded, that the fatal hæmorrhages that have enſued, together with the ſtinking breath, the fetid urine, and cadaverous ſtools obſervable in this caſe, have given ſufficient reaſon to believe that putrefaction has been cauſed thereby.

## SECT. LXXVII.

OUR liquids formed from our feeding on the parts of animals are various; 1. According to the different ſorts of food which the animal lives on; 2. According to the different parts of them which we eat ourſelves.

That the part which, according to the eſtabliſhed rules of health, is continually flying off from the ſubſtance of both ſolids and fluids, may by the conſpiring action of all the viſcera be ſupplied from the food, it is requiſite that this food ſhould lay aſide its own natural diſpoſition, and be converted into the nature of our humours; ſo that when it has been wrought up to the laſt degree of perfection, all the humours ſhall be of a reſembling nature, how different ſoever they may have been before. But this tranſmutation is not to be wrought but by the repeated action of the viſcera and veſſels continued for many hours together; for the aliment very often retains its own nature a conſiderable time; and then the liquids derived from it are different according to the different nature of the aliment we take down. But thoſe liquids, which are formed from animal food, more eſpecially differ from each other upon a twofold account.

For, *1ſt.* All animals may in this reſpect be divided into three claſſes; for either they live on vegetables only, as horſes, oxen, ſheep, *&c.* or on animal ſubſtances only, as the lapwing, the ſwallow, *&c.* or on both, as ſparrows, *&c.*

2. If cows milk be ſet in the open air in a hot day, it will turn ſour; the fleſh of the ſame animal will putrefy. The perſon that eats the milk therefore takes down an aliment that will turn acid of itſelf; and he that eats the fleſh, takes down a ſubſtance diſpoſed to putrefaction; or if the marrow be eaten, this, in a weak ſtomach, will more eſpecially incline to turn rancid. It is plain, therefore, that the different parts of the ſame animal are liable to very different ſpontaneous changes.

## SECT. LXXVIII.

FOR the animals that feed on herbs and water will have either an acid chyle, or a chyle that will eaſily turn acid, and conſequently will give a milk of the ſame nature. This in our bodies, following its own tendency, will act in much the ſame manner as a vegetable diet: ſee 61 to 76; and create a viſcid matter in the firſt paſſages reſembling cheeſe, which is here a peculiar ſort of viſcidity.

The chyle, which is formed of the food we take down, and even the milk itſelf, do as yet more partake of the nature of the food that is ſwallowed, than of the perſon who ſwallows it; ſo that whilſt the cow feeds in the meadow on graſs and water only, the chyle and milk ſhall both retain the nature of the graſs, and both incline to acidity.

A viſcid matter reſembling cheeſe.] The blood and its ſerum are ſtrongly diſpoſed to form concretions; and this circumſtance ſeems peculiar to the human liquids: the ſerum coagulates if expoſed to a greater degree of heat, but milk does not; and yet this milk, after it has flowed with the blood for twenty-four hours, turns to ſerum, and then acquires the faculty of concreting. This is wholly owing to the action of the veſſels of the liquids, and eſpecially of the lungs. The more remote therefore the liquids, derived from food, are from this laſt degree of perfection, the leſs power have they to run into concretions. Chyle will hardly coagulate, but milk, which is nothing but chyle that has flowed ſome time with the blood, may be ſeparated into three parts, cream, whey, and curd, which curd, when the whey is entirely preſſed, becomes cheeſe; ſo that the plaſtick nature of the blood begins here to ſhew itſelf in the milk. Upon eating of milk, this curd is ſeparated in the ſtomach and bowels from the other parts, and would fill the inteſtines with very bad viſcidities, if it were not divided by the bile; from whence ſo often ariſe the ſwelled bellies of infants. Being corrupted by its continuance in this warm paſſage, it frequently brings on very putrid diarrhœas; for cheeſe, though ſeparated from a milk diſpoſed to turn ſour, ſeems to have the moſt animal part of the milk in it; for when it is grown hard it becomes acrid, alcaline, and yields by a chemical analyſis very near the ſame particulars as the parts of animals.

## SECT. LXXIX.

SUCH animals as feed upon other animals have their juices eaſily diſpoſed to become alcaline.

For in theſe the chyle retaining the nature of the aliment inclines to an alcaline ſtate; for which reaſon a fiſh-diet cannot be ſupported for any length of time, unleſs ſauce or acid ſauces be added to it, or ſome other aceſcent food be taken with it. Thus all the creatures which live upon prey have almoſt conſtantly a fetid breath. The great author of theſe aphoriſms in a very ſevere fit of the rheumatiſm endeavoured to live upon nothing but veal-broth without any ſalt, in hopes of thereby eaſing the tormenting pains which he endured; but he found himſelf under a neceſſity of laying it aſide within five days, and was forced to have recourſe to whey, on which he lived alone for many days, and found great relief.

## SECT. LXXX.

If by the powers of the body (58) the aliments be reduced to ſuch liquors as are found in a ſtrong and healthy body, after four and twenty hours abſtinence from meat and drink; if then theſe are left to themſelves in reſt and heat, or if they are ſtrongly moved, they will acquire a beginning putrefaction, which is conſtantly the ſame.

In the foregoing paragraphs we have treated of the changes which happen to the humours derived from the aliments, before they have by the action of the body put on the nature of our liquids; in this it is explained, how the ſame humours are changed after they have laid aſide their alimentary nature, and been converted into humours like our own. Lower has obſerved (*a*), that upon bleeding within four or five hours after a large meal, there ſhall be diſcerned a conſiderable quantity of a milky chyle intermixed with the blood, let it be drawn from any vein or artery whatſoever; and that this obſervation ſhall hold good, whether the blood be taken from men or other animals; but that when the chyle had circulated with the blood ſome time longer, it loſt its whiteneſs, and was attenuated into ſerum: ſo that if a vein was opened at a conſiderable diſtance from a meal, there would be not the leaſt ſign of any milky appearance, but

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(*a*) De corde, pag. 238.

but the ſerum only with the coagulated part ſwimming in it.

For this reaſon the nature of milk is very different according to the different time of its being drawn off after a meal. For if the crude milk be firſt drawn off, what comes ſome hours after has ſcarcely any acidity in it; and the cheeſe made from it is diſpoſed to be putrid and fetid, of which kind is the cheeſe that comes from Leige, which ſome people ſo much admire.

When therefore no food ſhall have been taken down for twenty hours or more, there is then nothing left remaining of the nature of the aliment, but the whole has acquired the nature of our proper humours. Now all our liquids, if expoſed to the heat of the common air, will putrefy, though a man live meerly upon acid ſubſtances or ſuch as are diſpoſed to become ſo; for which reaſon they are all of them but one degree diſtant from a ſtate of putrefaction. In health indeed there is nothing in the body that can become abſolutely putrid, being thrown out of the body by the excretory paſſages, before it can arrive at this ſtate.

But all animal humours will putrefy much the ſooner if the animal uſe any ſtrong exerciſe. Thus after hard running, or any exceſſive labour, how rank is the ſweat, how ſtrong and fetid the urine? If a woman that gives ſuck falls into an acute fever, unleſs ſhe drinks very plentifully, her milk, in a few hours, will become thin, yellowiſh, ſalt, and have ſomething of an urinous taſte.

## SECT. LXXXI.

BUT in food of the animal kind, there is that diſpoſition to putrefaction already, even before any change was wrought on it in our body.

A ſtrong healthy woman lives on bread, milk, beer, and the ſummer-fruits, and forms her milk from theſe, which, if ſhe abſtain from all food for twenty-four hours, may degenerate into an alcaleſcent nature. But this effect will be ſooner produced, if the aliment ſhe takes down be of itſelf diſpoſed to be of an alcaline nature. For which reaſon it is, that in great mens houſes, where the nurſes are frequently obliged to live upon broths only, they ſhall loſe their ſtrength, and have a ſalt ſubalcaleſcent milk ; and as ſoon as they return to aſceſcent diet, their ſpirits ſhall return, and their indiſpoſition leave them.

## SECT. LXXXII.

THIS putrefaction (80, 81) ſignifies ſuch a ſtate of humours, wherein the water in a great meaſure exhales away ; the ſaline part being attenuated and deprived of its acid, or even changed, and ſeparated from its earth and oil, becomes acrid, volatile, alcaline ; and the oily ſubſtance ſhall in part grow thinner, and receding from its earth, and mixing with that ſharp ſalt, ſhall become acrid, volatile, and fetid ; whilſt the remainder being moſt pertinaciouſly joined to the earth, which now wants its water, ſalt, and other part of oil, ſhall change into black and denſe fæces, incapable of paſſing through the veſſels in the ordinary courſe of the circulation.

The alterations are here deſcribed, which happen to the humours of animals, whilſt they putrefy.

The water in a great meaſure exhales.] A whale being thrown on ſhore here, that vaſt body by putrefaction waſted all away in a few weeks, ſo that nothing was left of it but naked bones : ſuch therefore was the power of putrefaction, as to render the whole ſubſtance of it volatile. Now as water is the moſt moveable part of all the humours, and comes away firſt in every chemical proceſs, this will therefore be the ſooneſt carried off.

The ſaline part.] The blood of a ſound animal, when freſh let out of the veins, ſhews no ſign of having any alcaline ſalt contained in it; if it be dropped into the eye it gives no pain: but if it be kept in a like heat with that of the body but three days, it will corrupt, ſtink, become acrid, and yield by a gentle diſtillation a volatile alcaline ſalt, though the native ſalt of the blood is neutral and much more fixed; its nature therefore is entirely changed by putrefaction. That putrefaction will alſo change acid ſalts into alcaline, may be learnt from that very acid plant ſorrel, which when putrefied yields a volatile alcaline ſalt.

The oily ſubſtance alſo, *&c.*] The volatile alcaline ſalt drawn from putrefied animals by diſtillation never comes off pure, but is yellowiſh and foul, being intermixed with a very ſubtle, acrid, fetid oil: the oil of the blood, therefore, which is naturally ſo fixed, becomes ſo volatile by putrefaction, as to riſe with the volatile alcaline ſalt by a gentle heat.

But the other part of the oil, *&c.*] For it is not the whole quantity of oil, but a certain part only, that is made volatile by putrefaction: the reſt unites with the earth, and very tenaciouſly coheres with it. From putrefied urine is drawn a thin oil, together with a volatile ſalt; but in the reſiduum there is left a large quantity of oil, that does not yield to the hotteſt fire. So alſo in atrabilarious diſeaſes we ſee, that when the moſt moveable part of the blood are carried off, the remaining tenacious pitchy part, that adheres moſt ſtubbornly like the dregs of oil, ſhall oppreſs the abdominal viſcera, and bring on the moſt obſtinate chronical diſeaſes.

## SECT. LXXXIII.

INSECTS, fiſhes, amphibious creatures, birds, beaſts of all kinds, reptiles, and even men, of their own nature conſtantly incline to this putrefaction (82), but never turn acid.

All the known animals except a few juiceleſs inſects (for moiſture is required to putrefaction, and the parts of animals never putrefy if they are dried), putrefy, if expoſed to the heat of an air, which ſhall cauſe the liquid to riſe in the Fahrenheitian thermometer to any degree between the 32d and the 92d: the greater the heat is within this limit, ſo much the ſooner for the moſt part will the putrefaction begin (for beyond the 92d degree the heat rather dries up all moiſture and ſo hinders putrefaction), and the nearer the deſcending liquid approaches to a like degree of coldneſs with that of ice, the ſlower the putrefaction comes on. In fiſhes it generally comes on very ſoon; more ſlowly in other animals. Nor does it appear by any experiment, that the parts of animals have ever degenerated of themſelves into an acid. This therefore it ſeems may be taken for a general rule.

## SECT. LXXXIV.

THE antecedent cauſes of this putrefaction (82) are: 1. Feeding upon animal food, except the milk of grazing cattle (78), eſpecially upon inſects, fiſhes, birds of prey, and alcaleſcent vegetables. 2. A fulneſs either of good blood, or of blood acceding towards putrefaction. 3. The great ſtrength of the veſſels, viſcera (50 to 54), bile. 4. Stagnation or too much agitation through the animal motion either growing languid or being raiſed too high. 5. Great heat affecting the body frequently and long.

The action of the body upon the aliments we take down, though they can naturally incline to acid and not to a putrid alcali, may ſo change them, as to render them like to ſound humours, and make them aſſume the nature of a beginning putrefaction (§. 80). If the aliment therefore inclines to putrefy of itſelf, it will conſpire with the action of the body, and that diſpoſition to putrefy will come on the faſter. For this reaſon no man can live long on fleſh or fiſh alone without ſalt, or ſome acid or aceſcent vegetables taken with it; he would in this caſe ſoon languiſh and loathe his food: and yet there are animals that live on fleſh alone and drink nothing. This Geſner affirms of eagles, and obſervation now ſhews it to be true; yet by experiments made on men, it has appeared, that they cannot enjoy their health long, if they live only on alcaleſcent food.

Of how great efficacy good blood is in aſſimilating the aliment, we have already obſerved §. 25. Numb. 1. that being the chief means of changing the crude aliment into our humours. For this reaſon the moſt healthy and plethorick perſons are moſt liable to putrid diſeaſes, when ſuch a conſtitution is epidemical, whilſt weak people, ſubject to an ill habit of body, and ſuch as are full of mucous and viſcid humours, are ſcarce affected; the condition of thoſe therefore that are perfectly well is the moſt dangerous. If a plethorick man uſe hard labour, his ſweat is very rank, his urine red, acrid, and almoſt putrid. Too great heat in thoſe bodies, which abound too much with good blood, greatly increaſes this tendency to putrefaction.

3. The two chief means of aſſimilation are the mixture of a little crude matter with a large quantity of concocted humours, and the action of the veſſels

and viſcera; of the former we have treated in the preceding number, and ſhall ſpeak to the latter in this. The chyle mixing with the blood flows together for ſome hours, 'till by the continual action of the veſſels and viſcera it is changed into ſerum and blood; and the ſtronger that action is, the ſooner is this performed. For which reaſon ſtrong men, that uſe hard labour, are capable of digeſting hard ſour bread, ſour butter-milk, and fleſh hardened with ſmoke and ſalt, and turning it into good blood, whoſe property is always to incline to putrefaction and never to turn acid. Should ſuch men eat broths, tender fleſh, *&c.* they would preſently grow faint, unleſs by taking down acids they conquered the too great diſpoſition which this kind of food has to putrefy.

Bile.] Of all the liquids of the body in health, except ſuch as are excrementitious, the bile is the moſt acrid, and inclines moſt to putrefy. For which reaſon dead bodies corrupt ſooner about the parts where the bile is found, than they do in any other place. In acute diſeaſes it ſpeedily degenerates, and frequently produces moſt terrible miſchief. The bile, when mixed with the chyle in the duodenum, impreſſes upon the food what may be called the firſt character of humanity, and changes the acid or aceſcent part of it into an oppoſite nature. This therefore is a principal inſtrument in the formation of the chyle. For this cauſe fiſhes, which are of a cold nature and have no teeth, have the moſt acrid bile. But if this bile either exceeds in quantity, or begins to putrefy, it brings on an univerſal corruption, and gives riſe to the moſt acute putrefying diſeaſes.

4 The want of motion in our liquids, or an exceſs of motion in them, will both produce putrefaction; and thus two directly oppoſite cauſes will produce the ſame effect.

A man ſhall live to eighty years and upwards without any putrefaction; he then dies, and all motion ceaſes, and all the liquids ſtagnate, and within three days or leſs the body ſhall putrefy. The ſame thing ſhall happen to the moſt healthy man when drowned, in which caſe the liquids remain the ſame, only motion is wanting, and putrefaction ſoon follows.

Too great agitation on the other hand brings on putrefaction much ſooner. For an acute fever is capable in four and twenty hours of inducing ſuch an univerſal corruption, as may plainly be ſeen from the fetid urine, the cadaverous ſtools, and the very ſtinking breath; all which ſufficiently ſhew, that a general corruption prevails within.

Men that live in eaſe and indolence often die of a putrid ſcurvy, and their viſcera all rotten: and violent exerciſe ſhall raiſe a very high fever, that ſhall be attended with an univerſal tendency to putrefaction.

5. Where the heat is ſo great as to carry off all the moiſture, then dryneſs ſhall follow, which always prevents putrefaction, otherwiſe the greater the heat, the quicker is the putrefaction. Fleſh may be kept in winter-time for many days, which in the heat of ſummer ſhall ſoon be converted into a putrid ſubſtance: eſpecially if the air be moiſt at the ſame time. Hippocrates reckons among the diſeaſes of the ſummer, many which ariſe from the putrefaction of our humours; ſuch as continual burning fevers, exulcerations of the mouth, putrefactions of the genital parts (*a*). When ſea-faring men are becalmed and forced to lie ſtill for want of wind in very hot climates they are liable to be affected with the moſt putrid diſeaſes. From which circumſtance we learn how neceſſary the refreſhment of a cool air is to ſuch perſon as labour under putrid acute diſeaſes. Galen, deſcrib ing the nature of putrefaction, ſays (*b*), *Putredo eſ mutatio totius ſubſtantiæ corporis putreſcentis ad corrup telam ab externo calore; non enim à proprio calore cor rumpitur quidquam*, &c. *docent animalia ſana per mul tos annos ſine putredine viventia, ſi ſervetur eorum pro priu*

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(*a*) Aphor. 21. Sect. 3.

(*b*) Meth. Med. Lib. XI. cap. 8. Charter. Tom. X. pag. 254.

*prius calor*, &c. " That it is a change of the whole
" ſubſtance of the putrefying body to corruption by
" external heat; for nothing is corrupted by its own
" heat; as appears by animals living uncorrupt for
" many years, if their own heat be preſerved, *&c.*"

## SECT. LXXXV.

IN the firſt paſſage it occaſions thirſt, a loſs of appetite, fetid belchings, a ſtinking breath, ſmelling ſtrong of rottenneſs and corruption, bitteriſh putrid foulneſs in the mouth, tongue, palate, fauces, nauſea and vomiting of putrefied bilious matter, a loathing of every thing but what is watery or acid, putrid crudity, a bilious diarrhœa, iliac inflammatory pains, with the ſenſe of a troubleſome heat.

Here follows the effects of putrefaction produced in the human body, and firſt of all, the effects which are obſervable upon any putrid matter inhering in the *primæ viæ*.

Thirſt.] This is the conſtant attendant upon any thing that is putrid here: for by much drinking nature endeavours to waſh it away. This clearly appears in hydropical perſons, who are ſeldom thirſty at the beginning, 'till the waters are corrupted by ſtagnation and a long continuance in the body, and then there follows an unconquerable thirſt. Hippocrates therefore reckons the want of thirſt a good ſymptom in a hydropical caſe. Such as have the liver corrupted are extremely thirſty, from the putrid *fomes* reſiding here.

Loſs of appetite.] This may ariſe from many other cauſes, but when thirſt is joined with it, it generally proceeds from this cauſe.

If a man in perfect health happens to be ſtanding by the body of a dead animal juſt at the time that its diſtended belly burſts, he will hardly avoid fainting away, and diſlike all kind of food for a conſiderable time after. If a man ſwallows the leaſt bit of a rotten egg, an univerſal nauſea ſhall preſently ſucceed. What then muſt be the conſequence, where ſuch a putrid maſs lies near the ſtomach, diſperſing its putrid ſteams through all the inner parts. Hence proceeds that inſuperable loathing of food in diſeaſes which ariſe from the lodgment of a putrid bile in the parts here adjacent.

Fetid belchings.] We have already explained from whence belchings ariſe §. 63. When a man belches, the ſmell of what is in the ſtomach firſt ſtrikes his noſe; if it be putrid, it proceeds either from the aliments putrifying there, or from ſome corrupt cauſe reſiding in the viſcera.

Foulneſs of the mouth, tongue, *&c.*] A prudent Phyſician never leaves a patient 'till he has inſpected his tongue and the inſide of his mouth, which ſo fairly ſhews the ſtate of the viſcera, whoſe office it is to form the chyle, as alſo of the lungs. Nothing exhales from the mouth of a man in health but the moſt limpid dew. But in diſeaſes where the unpaſſable humours obſtruct the extremities of the exhaling veſſels, the back of the tongue begins to be rough and dry, its colour turns pale, yellowiſh, brown, and at laſt black; nay ſometimes all the gums and teeth are covered with ſuch a cruſt: this is a very different thing from a thruſh (with which it is often confounded) and may properly be called by the name of filth, which when a due perſpiration is reſtored is all abſterged by the force of the vital liquid, and the uſual clearneſs of the tongue returns. When this foulneſs is owing to inflammatory obſtructions, it is generally attended with a great dryneſs; but if it proceeds from a putrid viſcous obſtructing matter, there is commonly a greater degree of moiſture, unleſs theſe two cauſes concur, that is, an inflammatory denſity and putrefaction too, as is often the caſe in acute diſeaſes. And farther according as the ſurface of the tongue is, ſo is the inner ſurface of the œſophagus, ſtomach, *&c.*

A ſtinking breath, *&c.*] When any putrid matter is lodged in the *primæ viæ*, and eſpecially near the ſtomach, it often cauſes ſurpriſing diſeaſes, that diſorder the whole nervous ſyſtem, and pervert every action of the brain; and this not ſo much from the putrid humours being reſorbed by the veins, and carried in the courſe of the circulation to the brain, as by the exhalation of its poiſonous ſteams. If putrid bile be collected and lodged in theſe paſſages, or be produced and fixed here by any diſeaſe, the violent pains of the head, vertigo's, deliriums, wildneſs, and rage, *&c.* which enſue, would almoſt tempt one to believe, that the cauſe and ſeat of the diſorder lay in the head; but all the miſchief ceaſes at once, when the foulneſs collected is once thrown out of the ſtomach by a gentle vomit. For which reaſon Hippocrates reckons a vertigo, attended with a dimneſs of ſight and a pain near the upper orifice of the ſtomach, among the ſigns that forerun a bilious vomiting: and as the fetid ſmell ariſing from a putrid body is capable of throwing the healthieſt man into a fainting fit, and taking away all his ſtrength in a moment, ſo may ſuch a putrid matter within, by its offenſive ſmell and ſpirituous kind of ſteam, diſorder all the parts within.

Nauſea and vomiting, *&c.*] Bile, the moſt acrid of all the humours, is the ſooneſt ſubject to putrefaction, ſo that if there be any thing putrid lodged in the *primæ viæ*, it is changed immediately. Farther, putrefaction here entirely takes away the appetite, ſo that perſons who have this complaint, can ſcarce bear any food but what is watery and acid, which eaſily paſs off, and for this reaſon the ſtomach is hardly diſtended, in which caſe the pylorus lies always open, and there is an immediate commerce between the ſtomach and the duodenum; which at laſt, as it receives all the humours ſecreted by the liver, the pancreas, and gall-

bladder,

bladder, but does not ſo eaſily tranſmit them along, being cloſed by ſo many wrinkles, will make theſe liquids apt to regurgitate up into the ſtomach, where the air has a free acceſs, and by this means will expoſe them to a ſudden putrefaction; this is the cauſe of that nauſea and vomiting of bilious putrid matter in the autumnal epidemick fevers, which ſo uſually rage after the exceſſive heats of ſummer, and which, unleſs the corrupt bilious matter be thrown off by nature or art, end in a moſt putrid diarrhœa, and frequently carry off the patient.

A loathing of every thing but what is watery and ſharp.] By obſervations both on men and beaſts it appears, that a diſeaſe often directs to the application of a proper remedy, though otherwiſe unknown, and creates an inſuperable longing after ſome particular things and an averſion to others. Why this ſhould be ſo we know not, but we find the fact to be certain by experience. When the body is dried up with violent heat, thirſt compels us even againſt our wills to ſeek a remedy. If any thing putrid is lodged in the *primæ viæ*, the patient preſently loathes every thing that is apt to putrefy. Offer roaſted meat to a man in a putrid fever, he cannot bear either the ſight or ſmell. Offer him lemons or oranges, he greedily ſnatches at them. And this is ſtill the ſame caſe, whether the patient be himſelf a Phyſician of judgment, or an innocent child. Now it is a great inſtance of a Phyſician's diſcretion to obſerve in diſeaſes theſe particular inclinations. The Phyſicians, who, from a preconceived hypotheſis denied all drink and condemned all acids in very hot diſeaſes, were very unfortunate in their cures. Nature, ſufficient of herſelf to ſupply all her wants, calls for water and watery ſubſtances to waſh away the putrid matter by urine or ſweat, and for acids to correct it.

Putrid crudity.] Though the aliment be ſo changed by the power of the body, that by reſt and heat, or great motion, they would begin to putrefy, §. 80.

yet putrefaction is never found in the humours of a ſound body. Every thing therefore that is actually putrid muſt be a crudity: for the concocted humours are bland, neither alcaline nor acid. If the aliment, therefore, or the liquids which are found in the *primæ viæ*, turn to putrefaction, there ariſes here a putrid crudity; which will increaſe every moment, becauſe of the free acceſs of the air, the heat and moiſture of the *primæ viæ*, and becauſe the whole power of the body conſpires with it by its action on the aliment; for by this power it is, that aliments, the moſt remote from putrefaction, are converted into the nature of our humours, which are liable to putrefaction; how much more then will this power, when it is acting on a matter that is already putrid, increaſe that corruption.

A bilious diarrhœa.] When any thing putrid is lodged in the *primæ viæ*, the bile preſently begins to corrupt, and by its poiſonous ſtimulus brings on very putrid ſtools, in which there is brought away a very fetid matter reſembling melted cheeſe. In acute diſeaſes it often happens, that the bile, when it is corrupted by the violence of the diſeaſe in the beginning, ſhall cauſe a perpetual nauſea; and if not thrown off by vomiting, or corrected by acids, will in the end bring on a very putrid bilious diarrhœa, which is then ſo dangerous, from the patient's ſtrength being already ſo much reduced by the violence of the diſeaſe. Bellini has obſerved, that a few grains only of the yolk of a rotten egg is capable of bringing on the moſt violent hypercatharſis.

Inflammatory illiac pains.] Every kind of acrimony may irritate the nerves diſperſed through the inteſtines, from whence may follow their ſpaſmodick contraction and inflammation: eſpecially when by the ſoapy virtue of the acid bilious matter the mucus is abraded, that defends the very fine extremities of the nerves, which are ſpread over the internal coat of the inteſtines, and cauſes them to become much more ſenſible.

A troubleſome ſenſe of heat.] How much heat is generated by putrefaction appears from hay thrown into heaps, which by putrefaction will break out into flames. In the continual fevers, which from their effects are called putrid, the principal diagnoſtick ſign is an intenſe heat. In violent fevers, whilſt the external parts are cold, the patient ſhall be inwardly parched. And how ſuddenly in theſe fevers ſhall an univerſal putrefaction enſue? The legs of an hydropical perſon, though cold as marble 'till the ſtagnating lymph begins to putrefy, ſhall then grow hot and be inflamed. An infant that died of the plague continued warm for two days after (*a*).

## SECT. LXXXVI.

WHEN in the blood it produces the putrid diſſolution of it; an alcaline oleoſe volatile acrimony; it renders it unfit for nouriſhment, and prone to waſte; it deſtroys the ſmalleſt capillary veſſels; and for this reaſon it diſorders, depraves, and deſtroys, all the actions of both the ſolid and liquid parts; whence the circulation, ſecretion, excretion, become irregular; and conſequently burning fevers enſue, the urine with every other ſecreted liquid grows putrid, inflammations follow, gangrenes, mortifications, death.

The putrid diſſolution of it.] The blood of a ſound man, within a few minutes after it is drawn from the vein, coagulates into a red homogeneous maſs; from which, after it has ſtood ſome time, a thinner ſerum is ſeparated, the thick red part ſtill remaining concreted. And yet this kind of blood, if expoſed to a reſembling

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(*a*) Vander Mye de morbis Bredanis, pag. 8.

bling heat with that of the body for ſome time, ſhall begin to putrefy and grow thinner, and never after coagulate again. When the bile in a jaundice is thrown back into the blood, if the diſeaſe be of long continuance, the blood will be diſſolved thereby and diſpoſed to putrefy; ſo that a dropſy ſhall enſue from the blood's being too much diſſolved. In a putrid ſcurvy the blood is ſo diſſolved, as not to be kept within its own veſſels, but ſhall cauſe ecchymoſes, ſpots, and violent hæmorrhages. At the ſiege of Breda, when the plague raged in the town, the blood of the infected appeared to be livid, and fetid, and would not coagulate (*a*).

An alcaline oleoſe volatile acrimony.] The blood, probably, never actually putrefies in the body whilſt the man is alive, (for death would come on firſt by the deſtruction of the fine veſſels in the cerebrum and cerebellum) yet it may ſo nearly approach to this ſtate, that it ſhall immediately putrefy when expoſed to the air, as may be ſeen in the gums when they are affected with the putrid ſcurvy, for here the bloody matter flows from the eroded veſſels ſtinking like a dead carcaſe.

Unfit for nouriſhment.] The white of an egg, which we are certain nouriſhes the young chicken, has a remarkable tenacity; the ſerum of the blood, which appears by experiments to bear a great reſemblance to the white of an egg, has a like plaſtick coheſion. Something like it alſo begins to be formed in milk, as may appear from the cheeſe it contains; ſo that ſuch a coheſion in our humours ſeems neceſſary for the nouriſhment of the body; but this is deſtroyed by putrefaction. The white of an egg putrefying becomes as thin as water; the ſerum of the blood when putrid does no longer coagulate, though expoſed to the fire; and in the diſeaſes ariſing from ſome putrid matter lying in the body, all the humours are diſſolved, nutrition fails, and the patient dies of a

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(*a*) Vander Mye de morbis Bredanis, pag. 14.

ſlow conſumption; as is plain in phthiſical caſes, where the night-ſweats, the colliquative and putrid diarrhœa, atrophy, and death, ariſe from the blood's being too much diſſolved.

Prone to waſte.] This particularly appears in that kind of waſting, which the Engliſh term a conſumption; in which diſeaſe the body conſumes by degrees, without any remarkable defect in the lungs. It ſeems to take its cauſe from living too much upon fleſh-meat, whereby the humours inclining too much to an alcaline indiſpoſition, loſe their plaſtick tenacity; by which means the patient diſſolves in ſweats, and waſtes away by degrees.

It deſtroys the ſmalleſt capillary veſſels.] The urine carries off the ſalts of the blood when grown too acrid; when therefore this ſecretion or excretion is hindered by any cauſe, this depuration of the blood is not wrought. This acrimony is increaſed by the action of the vital parts every moment; and the diſorder ſhews itſelf firſt in the very tender veſſels of the brain and cerebellum; for which reaſon after a long iſchury there generally enſues a drowſineſs, delirium, and death. And poſſibly it may be from this cauſe, that the very ſubtle poiſon of the plague, which induces an univerſal putrefaction, ſhall kill ſo ſuddenly, by deſtroying the very ſmall capillary veſſels.

And for this reaſon all the actions, *&c.*] To perform the actions neceſſary to health, there is required a due coheſion in the ſolids, and a conſiſtence in the fluids proportional to the veſſels they are to flow through. But when the humours are become too thin by putrefaction, they enter into other veſſels than they ought, and of bland become acrid; by which means the body declines from the rules of health in the diſcharge of every function. In very acute fevers, where there ariſes ſo ſudden a putrefaction in all the humours, the functions are all injured immediately, and of conſequence all the humours are changed into a worſe ſtate than they were in before;

fore. For in the very beginning of theſe diſeaſes, the quick and difficult reſpiration, the very ſwift and oftentimes unequal pulſe, ſhew plainly that the vital functions are diſordered; as the animal appears to be alſo from the extreme weakneſs, delirium, drowſineſs, &c. uſually attending theſe caſes; and again, the loſt appetite, the thirſt, nauſea, and vomiting, plainly point out the diſorder of the natural functions; the ſaliva, bile, ſweat, urine, ſoon after degenerate; and thus nothing healthful being left in the body, the event is commonly ſo fatal.

Burning fevers.] Hippocrates has obſerved (*b*), that burning phrenitick fevers follow a courſe of gentle (*c*), moiſt, ſoutherly winds; and that is the conſtitution of the air likewiſe that ſo much diſpoſes to putrefaction, ſo that in a moiſt warm air fleſh will diſſolve in a few days into a putrid matter. Where the exalted *atra bilis*, which naturally is ſo obſtinately fixed and tenacious, is diſſolved by any cauſe whatever, corrupted, and mixed with the blood, there will follow a moſt violent fever that carries a ſudden deſtruction to all around it.

The urine, and every liquid that is ſecreted, putrid.] Theſe liquids all follow the nature of the blood from which they are ſecreted. By the appointment of nature the urine is to waſh away, and carry off the more acrid ſalts and oils, and whatever approaches near to corruption. When the blood therefore is putrid, the urine will have the ſame taint; as alſo the ſweat, &c.

Inflammations, ſuppurations, &c.] We learn from the moſt certain obſervations, that whatever is acrid may cauſe an inflammation either in the whole body, or in any particular part, by its ſtimulus: putrid acrimony, therefore, may bring on an inflammation. Beſides, the ſeveral ſorts of humours being diſſolved by putrefaction,

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(*b*) Epidem. 3. Charter. Tom. IX. pag. 259, 260.

(*c*) Μάλθακον, Galen in his Commentaries explains by ἄπνουν καὶ θέρμον, ſerene, without winds, and warm.

putrefaction, will enter into other veſſels than ſuch as properly belong to them, and often will not be able to paſs through the extremities, from whence will ariſe another cauſe of inflammation occaſioned by putrefaction. The ſpleen of a calf freſh killed was applied for twenty-four hours to the nape of a man's neck for an opthalmia, and by the heat and moiſture of the body it grew fetid and putrefied; and the place to which it was applied had all the ſigns of a violent inflammation. But if an inflammation be once raiſed, the conſequences of it will follow of courſe, to wit, ſuppuration, gangrene, or ſphacelus, as ſhall hereafter be ſhewn in the account of an inflammation. This would not be quite ſo terrible in the external parts, but muſt be very dangerous in the ſmaller veſſels of the moſt tender viſcera. In very acute fevers it is obſerved, that ſuch malignant humours are thrown off by abſceſs on the extremity of the body as cauſe the preſent death of the part, and a ſphacelus which ſhall extend even to the bone: as Hippocrates has obſerved in his prognoſticks, that ſuch parts ſhall turn quite black and fall off, and yet the patient ſurvive, provided he ſeems to bear it eaſily, and any other good ſymptom appears (*d*).

## SECT. LXXXVII.

FROM theſe things (76, 79, 80, 81, 82, 83, 84, 85, 86) the diagnoſis and prognoſis, as well as the cure of the diſeaſe, clearly appear.

How to deduce the diagnoſis, prognoſis, and curative indication, from the hiſtory of the diſeaſe before given, has been already ſhewn in one general example, §. 27. Thus in this diſeaſe the cauſes foregoing, §. 84. and its effects, §. 85. and 86. demonſtrate its preſence; the prognoſis will then be, that all theſe bad

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(*d*) Charter. Tom. VII. pag. 624.

bad circumſtances are to be feared, which faithful obſervation has ſhewn to follow from it; theſe are related, §. 85. and 86. then from theſe being well underſtood whatever is requiſite to a cure may eaſily be deduced.

## SECT. LXXXVIII.

WHICH is performed, 1. By ſuch ſolid and liquid food, as ſhall ſpeedily turn acid, or are already ſo, of which kind are the mealy ſubſtances boiled in water, or digeſted 'till they begin to corrupt; milk and its productions, as being drawn from herbs, the ſummer-fruits, their acid crude juices, or the ſame fermented and turned into wine or vinegar; 2. By acid medicines from crude or fermented vegetables, or by ſalts and ſulphur turned into acids by the force of fire; 3. By the ſalts that abſorb alcali's, ſuch as ſal-gem, ſea-ſalt, and nitre; 4. By watery diluters; 5. By mild obtundents, ſuch as mealy vegetables, emulſions or decoctions; and the much commended boles, conſiſting of a concealed balſamick acidulous part, and a certain viſcid part that is exceedingly demulcent; 6. By ſoapy abſtergent acid ſuboleoſe medicines, oxymel, the ſapæ acetoſæ, robs; 7. By reſt, ſleep, vapour-baths, or fomentations.

1. It is plain that the whole cure is two-fold, and conſiſts either in expelling the alcaline putrid matter out of the body, or changing it ſo as that it ſhall be capable of doing no farther miſchief; and then in giving ſuch meat and drink, as ſhall never putrefy of themſelves, but rather lean to the oppoſite ſtate of acrimony, that is, which ſhall be apt to turn acid; of which ſort are all the before-mentioned ſubſtances; namely, the ſeveral kinds of grain and ripe ſeeds

which may be ground into flour. For theſe diluted in water will turn ſour by a gentle heat, ſome ſooner, and others later, the decoctions of oats and rye ſooneſt of all, and next of barley; but rye eſpecially either boiled or ſteeped in water will turn to an acid, that is acrid enough. The artificer knows, that tin will not ſtick to iron-plates, unleſs their ſurface be extremely ſmooth; to this end they ſteep the iron-plates in water made acid by an intermixture of a few grains of rye (*a*). Hippocrates gave a ptiſan, the cream, or juice of barley in all acute diſeaſes, as may be ſhewn from many places in his works.

Milk and its productions.] Pure milk is not altogether ſafe in putrid diſeaſes; for though it is all apt to turn acid, if the animal, from whence it is drawn, be fed with herbs, yet it has cream in it which may grow rancid, and cheeſe which partakes of the animal nature, and may putrefy. In very acute diſeaſes therefore it is not to be allowed, unleſs diluted very much with water, or in the form of whey, and eſpecially the whey of ſour butter-milk ſtrained through an Hippocrates's ſleeve: this thin whey, ſo agreeable for its acidulous taſte, is of excellent uſe in all putrid diſeaſes.

The ſummer fruits.] Whoever is afflicted with a diſeaſe of this kind is naturally led to deſire eagerly theſe grateful fruits. Many years ago almoſt all Phyſicians in general oppoſed this practice; and when the celebrated author of theſe aphoriſms allowed cherries, mulberries, and currants, to a perſon of diſtinction in an acute diſeaſe, it was thought a crime deſerving the publick animadverſion; in the mean time they, who condemned this method, daily gave the juices of the ſame fruits boiled up into a ſyrup with ſugar. The juice of ripe fruits needs no preparation, it allays thirſt, cools, relaxes the belly and urinary paſſages, and affords the greateſt relief when the ſtomach ſuffers from a putrid bile. In very hot countries healthful

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(*a*) Acad. des ſciences, l'an. 1725. Mem. 152.

healthful people live almoſt entirely on theſe fruits; and when the bile is exalted by the ſummer heats, it is happily aſſwaged by theſe mild juices. Galen, who almoſt univerſally condemns the uſe of theſe temporary fruits, ſays, "they are good for thoſe only who "are almoſt dead with violent heat and long journies; that then they relieve the parched ſtate of "the body by moiſtening it, and if they are eaten "cold, are moderately cooling (*b*);" *illis ſolis prodeſſe, qui æſtu vehementiori & longiore itinere ſeſe confecerint; tunc enim juvant corporis ſqualorem humectantia, &, ſi frigida ſumantur, moderate refrigerantia.* Thus he unwillingly acknowledges the excellent uſe of the fruits which he had condemned. Theſe juices are either naturally acid, as in currants, ſome cherries, *&c.* or ſpeedily become ſo by fermentation, and then they acquire the nature of wine or vinegar. But wine itſelf is good in theſe diſeaſes, and even in the moſt acute, eſpecially the acid ſorts; but then they muſt be very much diluted with water. In Germany it is cuſtomary to preſerve the fleſh of boars from putrefaction in Rheniſh wine.

2. From vegetables.] There are very many vegetables which naturally contain an acid, as all the ſpecies of ſorrel, wood-ſorrel, tamarinds, *&c.* which are to be ſold in every ſhop, and will ſerve to compoſe the moſt agreeable and efficacious medicines. Hither is to be referred the acid prepared by fermentation, *i. e.* tartar and vinegar, which excels almoſt every thing beſide; from vinegar are prepared the oxycrate and oxymel, ſo much commended by the Antients. Vinegar may be made from all fermented liquids, but from none better than wine: for all the conſtituent parts of the wine ſeem to be in the vinegar, only diſpoſed in a different manner. Vinegar is reckoned by all among the beſt prophylactick medicines to keep

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(*b*) De aliment. facult. Lib. II. cap. 2. Charter, Tom. VI. p. 326.

keep off the plague, as its ſmell is ſo reviving in all putrid diſeaſes.

Or ſalts and ſulphur, *&c.*] Almoſt all the acid vegetables, and eſpecially vinegar, diſſolve the blood; putrefactions alſo bring on too great a diſſolution of the humours; when then there is either a diſſolution of the humours from putridity, or there is reaſon to apprehend it coming on, the acid ſpirits drawn by fire from ſea-ſalt, nitre, vitriol, will then be of the greateſt ſervice; theſe reſiſt all putrefaction moſt powerfully, at the ſame time not diſſolving, but rather coagulating the humours. The ſpirit of ſulphur *per campanam*, as it is called, is ſingularly ſerviceable in this caſe, being the pureſt foſſile acid without any metalline ſubſtance intermixed with it.

How great the efficacy of theſe foſſile acids is we are taught by Sydenham, who in the worſt ſort of the confluent ſmall-pox gave ſpirit of vitriol in the common drink with the greateſt ſucceſs, after other remedies had been tried in vain (*c*); in which diſeaſe the whole body diſſolves into the moſt putrid maſs; and from whence it appears, how much theſe foſſile acids reſiſt putrefaction.

3. The abſorbents of alcali, *&c.*] Theſe ſalts ſprinkled on the fleſh of animals prevent putrefaction, as we learn by daily experience. They are always, therefore, of very good uſe, unleſs the motion of the humours be too violent, for then the danger is, leſt the blood, loaded with a great quantity of theſe ſalts, ſhould become more acrid, and being thereby more ſwiftly moved, ſhould deſtroy the very ſmall veſſels. Yet nitre, the lighteſt of them, is eaſily overcome by the powers of the body, and is therefore preferred to the reſt. Theſe ſalts, diſſolved in water, and applied to any of the external parts corrupted with a gangrene, will keep off all putrefaction.

4. By watery diluents.] According to the conſtitution of nature, whenever the ſalts become too acrid, and

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(*c*) Sydenham, pag. 299.

and the oils too thin and almoſt putrid, they are carried off by urine, and ſometimes by ſweat; it is of the greateſt uſe therefore to waſh them away by giving a large quantity of watery diluters; hereby the quantity of urine is increaſed, and a proper vehicle ſupplied for diſcharging the matter by ſweat; beſides, in all putrid diſeaſes, whilſt the patient continues in his ſenſes, he thirſts very much for water; in this therefore nature points out the way we ought to proceed.

5. Mealy emulſions or decoctions.] Theſe, by reaſon of the water they contain, dilute; but by means of the ſoft oily gluten reſiding in them they inviſcate whatever is acrid, and render it inactive, and for this reaſon are ſo very ſerviceable. All the mealy ſeeds when bruiſed and preſſed, yield a large quantity of a very ſmooth oil; but when they are pounded with water they give a very ſoft milky liquid, called an emulſion in the ſhops, which has the oil in it, but ſo changed as to turn acid rather than rancid; yet the virtue of the oil, whereby it inviſcates and blunts whatever is acrid, is ſtill left remaining in the emulſion, and there is no fear of its ever growing rancid.

The much commended boles.] Theſe medicated earths, as they are called, were much commended in the time of Galen, eſpecially that which was dug up in the iſle of Lemnos.

Dioſcorides thought (*d*), that goat's blood was mixed with this earth, and that then it was made into troches, and ſealed with the image of a ſhe-goat. Galen made two painful journies to Lemnos to diſcover the nature of this earth, and found, that goat's blood was never mixed with it, but that it was a fat earth; and that when the thicker parts were carried off by waſhing, it was dried to the conſiſtence of wax, divided into ſmall parts, impreſſed with the ſeal ſacred to Diana, and ſo ſold (*e*).

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(*d*) Lib. V. cap. 113.

(*e*) De Simpl. Med. Facultat. Lib. IX. cap. 1. No. 2. Charter. Tom. XIII. pag. 247.

There are many ſuch earths in the ſhops at this day, of which the beſt is perhaps what is called the Armenian bole; which feels fat and ſoapy to the touch, is of a pale red colour, has a little, and not diſagreeable, ſmell, and is eaſily pounded into a very ſmooth powder; it melts in the mouth like butter, and is thoroughly diluted with the ſpittle; to the taſte it has ſomething lightly aromatick, and at the ſame time ſomething drying. There is an acid in theſe earths wonderfully concealed, as appears by chemical obſervations. For the vague acid, which is termed foſſile, adhering in the bowels of the earth, forms different compoſitions, according as it is united to different bodies; for allom, vitriol, ſulphur, yield an acid, which has very nearly the ſame qualities in every reſpect. But becauſe vitriol yields it in the largeſt quantity, it is therefore called vitriolick. This acid mixed with ſea-ſalt, ſal-gem, or nitre, expels their acid ſpirits, unites with the part that is then left, and conſtitutes a new ſort of ſalt: theſe ſame ſalts mixed with Armenian bole yield the ſame ſpirits with a ſtrong fire; which is not becauſe the intermixture of the bole hinders the ſalts from flowing, for with chalk or ſand it will not ſucceed: whence it is concluded, that there is a vitriolick acid in theſe fat earths, which being made active by the fire, caſt out the acid ſpirits of theſe ſalts. It is no objection, that its mild taſte indicates no acrimony, for ſulphur that is quite inſipid contains a great deal of this acid.

From hence appears the great uſe of theſe medicated earths; for they reſiſt all putrefaction by their latent acid, and by their harmleſs mildneſs they are extremely demulcent. Whence they are of ſuch excellent uſe in putrid dyſenteries, if given in a due doſe, *i. e.* in an emulſion as it were, which ſhall have one ounce of it to one pound of water, and then be taken by ſpoonfuls; if only a few grains be given at a time, they are of no ſervice.

6. By ſoapy aſtergents.] In acute diſeaſes the fat is diſſolved by the great heat and motion attending them, and mixes with the blood, and thereby cauſes as it were an oily plethora; this oily diſpoſition cannot be eaſily thrown out of the blood by drinking only water and watery potions, and naturally grows more acrid every moment, the longer it remains; to this end therefore, ſuch ſoapy ſubſtances are added, as make the fat capable of mixing with water. The Antients uſed honey boiled with vinegar; we uſe honey and ſugar too, but more eſpecially the acidulous robs made from the juices of elder-berries, currants, barberries, *&c.* which as they reſolve all concretions by their ſoapy virtue, do alſo by their acidity powerfully reſiſt all putrefaction.

7. By reſt.] Muſcular motion increaſes the circulation and attrition of the parts againſt each other, and theſe, if increaſed, diſpoſe all the humours to putrefy. If a man fatigues himſelf with very violent exerciſe, his urine turns acrid, red, fetid; the ſame circumſtance is obſerved to happen in acute diſeaſes; for which reaſon the antient Phyſicians enjoined their patients, in ſuch caſes, to be kept quite ſtill, without noiſe or light, that a gentle ſleep might ſteal upon them when all their ſenſes were thus compoſed.

By vapour-baths.] By this method the veſſels being relaxed, the watery diluents inſinuate themſelves the more eaſily, the attrition is diminiſhed, and all the cutaneous paſſages are opened to carry off thoſe peccant humours the more eaſily, which by being grown too acrid would do miſchief, if they were detained any longer in the body.

Fomentations.] All the ſkin being bibulous abſorbs the remedies that are thus applied, eſpecially if wet ſpunges be applied to the parotids, the arm-pits, the groin, *&c.* for in theſe places eſpecially the ſkin is bibulous, and the great veins that run along there ſoon mix the abſorbent humours with the blood.

## SECT. LXXXIX.

WHENCE it appears when and why acrid belchings following after fetid ones are of ſervice? Why, and in what caſe, men recovering from diſeaſes complain of a troubleſome taſte, like that of ſal-armoniac? Why it is a good ſign in acute diſeaſes to have the ſweat ſmell ſour? What an acid, alcaline, or bilious acrimony is? What diſeaſes are to be properly called putrid? Why theſe happen chiefly to very ſtrong plethorick people? Whether ever any humours are found truly alcaline in a living body? Very rarely indeed? as I can ſpeak from experience. Poſſibly the urine, if long retained in the bladder, or abſorbed by a ſpongy ſtone, may ſometimes be ſo. Otherwiſe death comes on firſt, the pulpy extremities of the vital parts being conſumed by the acrid ſubſtances, before it becomes alcaline.

Why ſour belchings, *&c.*] This is not always a good ſign; for in infants and weak people, whoſe illneſs proceeds from an acid, theſe belchings are oftentimes very troubleſome, and bring on a ſevere heart-burning; but where the belching has been rancid and fetid before, and taken its riſe from a putrid matter in or about the ſtomach, ſour belching is in this caſe good, becauſe it denotes the putrefaction to be overcome, and that its oppoſite acid prevails in the *primæ viæ*. *In diuturnis lienteriis ructus acidus ſuperveniens, qui priùs non erat, ſignum bonum*; "Acid "belching that was not before, coming on after a "long lientery, is a good ſign," ſays Hippocrates in his Aphoriſms (*a*). The reaſon is plain, becauſe in a lientery, whatever is taken down immediately paſſes off,

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(*a*) Sect. VI. Aphor. 1. Charter. Tom. IX. pag. 245.

off; and ſtays not long enough to become acid; acid belchings therefore ſhew the ſtomach and inteſtines to be ſo far ſtrengthened, as that they can retain the aliment long enough to become acid.

Why, and in what manner, perſons recovering, *&c.*] This is what almoſt all perſons, who recover from very acute diſeaſes, experience in themſelves; every thing they take down taſtes very ſalt; broth, if ſtronger than ordinary ſhall taſte like brine. And the ſame circumſtance has been obſerved in thoſe who recover of the plague. This taſte ariſes from the correction of the putrid alcaline predominant quality by the acid or aſceſcent diet, whereby it is changed into a ſort of mild compoſite ſalt. And what farther ſeems much to contribute hereto is, that the tongue, which is always foul and rough during an acute diſeaſe, becomes very clean, and of an exquiſite ſenſe, when thoſe foul incruſtations are fallen off.

Why ſweat ſmelling ſour, *&c.*] In languid chronical diſeaſes ſweat ſmelling ſour is an ill ſign, as it ſhews the powers of the body to be quite ſpent; but in acute diſeaſes it ſhews, that the diſpoſition of the humours to a putrid alcaline nature is entirely overcome.

What an acid acrimony.] It is what ariſes from aceſcent aliment not well digeſted by the powers of the veſſels and viſcera: for all the humours that are properly animal incline of themſelves to putrefy. An acid acrimony therefore is owing ſolely to the aliment.

Alcaline.] This takes its riſe from ſuch aliments as are prone to putrefy, and from the ſtagnation of our humours; for while they move in the veſſels, it ſeems ſcarce poſſible that they ſhould putrefy, as the very tender veſſels of the cerebrum and cerebellum could not poſſibly bear the ſharpneſs of ſuch humours without being deſtroyed. All alcaline acrimony is firſt to be found in the excrements; thus there is often a true putrefaction in the ſtools, and a great diſpoſition towards it in the urine, in very putrid diſeaſes.

Bilious.] Of all the humours, except the excrementitious, there is none ſo apt to putrefy as the bile; for which reaſon in acute diſeaſes it corrupts preſently, and brings on a very noxious bilious acrimony. For as the circulation is increaſed in acute diſeaſes, a larger quantity of bile is ſecreted, which not being diluted with a ſmooth chyle, as in health, grows acrid, and thin, and mixing with the blood, brings on an univerſal diſorder.

Oleous.] Any oil corrupted, though very mild before becomes extremely bad. The very ſweet oil of almonds corrupts in ſummer-time within a few days, and will change its mildneſs into ſuch an acrimony, as ſhall occaſion an heat in the inſide of the mouth, in caſe it be ſwallowed. Marrow, which is of ſo ſmooth a nature, ſhall, when corrupted, turn the thickeſt bones into a carious powder by its intolerable fœtor and offenſive acrimony. And the tenacity, by which it ſticks to every thing it touches, ſhall increaſe its malignity.

What diſeaſes, *&c.*] All thoſe, which by increaſing the heat and motion, ſhall cauſe the humours to degenerate ſo very ſuddenly, as to approach very near to putrefaction. Of this ſort principally, are all accute continual fevers, and eſpecially ſuch as the antient Phyſicians, from their effects, called putrid; in which very often, from the firſt ſeizure, the foulneſs of the tongue, the acrid, red, fetid, urine, the very ſtinking ſtools, and the rank ſweats, ſhall give very convincing marks that there is a putrefaction begun.

Why theſe happen to the ſtrongeſt, *&c.*] Becauſe theſe have much good blood, great heat, and ſtrong veſſels, which ſpeedily change the aliment into an animal nature, *i. e.* diſpoſe it to putrefy: whence it has been often obſerved, that epidemick, putrid fevers, and even the plague itſelf, have generally attacked the ſtrongeſt men; while the weak, the old, and thoſe that laboured under chronical diſeaſes, have eſcaped without harm.

Whether even in a living man, *&c.*] There is no doubt but the humours extravaſated and collected either in the natural or in morbid cavities may putrefy, and the man be yet alive, eſpecially if the air have free acceſs to them; but we very ſeldom, if ever, learn from any obſervation, that a true putrefaction can take place in the blood itſelf, and the humours ſecreted from it, while they are moving in their veſſels during life. It may even be queſtioned, whether ever a true alcali has been found in the urine itſelf, which waſhes away the more acrid ſalts of the blood, even in the moſt putrid diſeaſes. I have ſeen one caſe, which inclines me to think that it may poſſibly happen, though very rarely. I was called to a young woman, that was grown up, in a putrid continual fever, on the tenth day of her illneſs, and I found her pulſe low, quick, and unequal; a tremulous motion in all the muſcles; the reſpiration deep and difficult; and yet ſhe was, notwithſtanding, free from delirium; and her urine, which had been made about three hours before, was extremely fetid. This I took away with me immediately, and poured upon it ſpirit of nitre, which occaſioned a violent efferveſcence: and within eight hours after ſhe died. This urine therefore was truly alcaline, but then it had ſtood three hours in the open air, and perhaps had lain in the bladder a conſiderable time before it had been diſcharged. The blood of a woman, who was afflicted with a kind of malignant eryſipelatous fever, when it was let out, ſtunk to ſuch a degree, that both the ſurgeon who bled her, and others who ſtood near her, fainted away through the offenſiveneſs of the ſmell. This Morton affirms that he ſaw (*b*).

Urine long retained in the bladder.] An old corn-merchant of this city labored under an iſchury, and the ſurgeon who uſed to relieve him, by drawing off the water with a catheter, being abroad, he refuſed to accept of the aſſiſtance of another, and ſo ſtayed 'till the

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(*b*) Apparat. Curat. Morbor. Univerſal. pag. 11.

the former came back the next day. Upon introducing the catheter, there came away ſo putrid an urine, that it ſtained the inſtrument, which was made of ſilver, with the colours of the rainbow, and farther gave the ſurgeon, who imprudently drew in ſome part of the putrid ſteam which iſſued from it, a ſlight peripneumony, which laſted for ſome days. And we are well aſſured from the moſt certain obſervations, that urine abſorbed by a ſpungy ſtone in the kidneys or bladder, may by its heat and continuance there become perfectly putrid.

Otherwiſe death comes on firſt, *&c.*] For theſe veſſels are ſo very ſmall, as to eſcape all notice of ſenſe, or even imagination, and conſequently would be preſently deſtroyed if expoſed to the touch of ſuch acrid fluids. They who die of a ſuppreſſion of urine, have all the functions of the brain firſt diſordered, and at length go off quietly in a fatal ſleep, though ſometimes they are convulſed before they die. In this caſe the acrid matter, that uſed to paſs off by urine, ſeems by being retained to deſtroy theſe tender veſſels.

## SECT. XC.

HENCE at length may be known, what harm may ariſe from the too great, or too little motion of the circulating humours, and how much its effects vary, according to the different places where they ſtop, and the humours upon which it operates? What ill effects proceed from the ſtagnation or extravaſation of the liquids? Nor is the origin obſcure of that viſcid gluten, that thickens our humours, when the ſtrong decoction of animals, prepared by long boiling, are taken down in too large a quantity; or even when the external parts of animals, and their viſcid tenacious extremities are uſed too much, or too long: for from hence ariſes another pituitous diſpoſition, and of a different nature from that which we have already explained (75).

What harm may ariſe from too great or too little motion, &c.] Both will cauſe putrefaction: thus a gangrene, that turns every thing to putrefaction, follows upon a violent inflammation; and the like ill effect will enſue upon a deficiency in the circulation: only in this latter caſe it comes on by more ſlow degrees, and in the former makes a ſwift deſtruction.

How much its effects vary, &c.] An increaſe of the circulation principally effects the parts that lie neareſt to the heart, from whence in burning fevers ariſes the intolerable heat that is felt about the pit of the ſtomach; and the greateſt danger lies where the veſſels are ſmalleſt, *i.e.* in the cerebrum and cerebellum. There is likewiſe a great difference in reſpect of the humours which are affected: the bile moſt ſpeedily corrupts in fevers, the urine preſently becomes acrid and more red, as by this the ſalts, which are moſt diſpoſed to putrefy, are naturally carried off; the other humours do not change ſo ſoon.

What the ill effects of a ſtagnation and extravaſation of the liquids?] So long as the humours circulate all things go on as they ſhould do, and a man lives to extreme old age without any putrefaction. But let a man be drowned, whereby the motion only of the humours is ſtopped, and let him be ever ſo ſound, he will putrefy in a few days; ſo that ſtagnation and extravaſation diſpoſe the humours to putrefy; though much more ſlowly indeed if the air be denied a free acceſs to them. This appears in contuſions, where though the blood is effuſed under the unbroken ſkin, it corrupts not eaſily, becauſe no air touches it, and the bibulous veins continually reſorb the thinner part.

Nor is the origin obſcure, &c.] The ſtrongeſt broths are perfectly glutinous, and oppreſs a weak ſtomach without increaſing ſtrength; but the thinner ſorts afford a good nouriſhment. And yet becauſe that which nouriſhes in them is what is ſeparated from the fleſh in boiling, many have thought, that the thicker they were the more they nouriſhed; whereas at length they acquire an inſuperable tenacity like glue, which the powers of the body are never able to overcome. This tenacity is much greater ſtill, if the mucilaginous and tendinous extremities of animals are the parts that are thus boiled; of which they make glue for the uſe of tradeſmen. Thus when decoctions of calves feet are given to phthiſical people with a view to nouriſh them, their weak lungs are oppreſſed with the too tenacious chyle, and very great diſorders ſhall follow upon it.

For from thence ariſes another pituitous diſpoſition, *&c.*] The gluten deſcribed §. 69 *& ſeq.* owes its origin to vegetables, eſpecially ſuch as are of a viſcid and mealy kind. This by retaining its viſcidity, either brings on very bad obſtructions, or when by being diluted either with the liquids we drink, or thoſe that flow to it from the reſpective glands ſet apart for this purpoſe, may ferment and turn ſour. But the glutinous matter that comes from the parts of animals long boiled, is firſt of all prejudicial by reaſon of its tenacity, and when corrupted offends by its grievous putrefaction. Common glue, when diluted with water, ſhall putrefy very ſpeedily, and emit an horrible ſtink.

## SECT. XCI.

HAVING thus treated ſeverally of the moſt ſimple diſeaſes of the ſolids and fluids, it now follows, that we ſhould treat of the moſt ſimple diſeaſes that occur in both ſolids and fluids together.

We have now laid down the ſolid foundations upon which, though ſo very ſimple, depends the knowledge and cure of compound and oftentimes the moſt intricate diſeaſes. After the moſt ſimple diſeaſes of the ſolids, and the ſpontaneous degenerations of the liquids, our method, §. 16. leads us to proceed to ſuch diſeaſes, as are of a more compound nature. Since as long as life laſts, there is a motion of the liquids through the veſſels; it is next to be enquired, what will be the effect, in caſe this motion be greater or leſs, than is naturally required to the preſervation of health.

## Of the DISEASES that ariſe ſolely from the EXCESS of the CIRCULATORY MOTION.

### SECT. XCII.

ALL the fluids, which are contained in any veſſel, that has its riſe from the great artery, are ſecreted from the blood only, which a little before was mixed together in the right and left ventricles of the heart, and appeared in the ſhape of one uniform liquid.

This is the firſt diſeaſe in which the ſolids and fluids are conſidered together, and in this chapter we treat only of the increaſed velocity of the motion of the fluids through the veſſels; it is neceſſary therefore in the firſt place, to enquire into the nature and properties of the liquid that flows through the veſſels.

All that liquid which flows into the right ventricle of the heart, and is expelled from the left, is termed blood. The heart receives the whole maſs of blood by the veins from the whole body, and diſtributes it again to every part by the arteries. From this blood the ſeveral parts of the body, with all the viſcera, derive their humours, which are various according to their various ſtructure. All the liquids of the body therefore are contained in the blood, though not in the form their diſtinct nature requires, but as to the matter, out of which is framed in every part, according to its peculiar fabrick, that which the adorable Creator had expreſſed in his infinite idea. When this is done, this matter, thus changed in the ſeveral different parts and viſcera, returns to the heart, except a certain portion of it, which is excreted and thrown out of the body. And this matter is called blood, both when it paſſes from the heart and when it returns to it again. And this courſe is conſtantly continued, ſo long as life remains.

So that it may juſtly be ſaid, that all the ſeveral humours are drawn from the blood, and all the humours contained in it.

This blood, conſiſting of ſo many different parts intimately united together, appears to be an homogeneous red liquid; and yet when left to itſelf will ſeparate into diſtinct parts.

## SECT. XCIII.

YET it has even there, and then, larger globules of a determinate ſize, of a changeable figure, and of a red colour: and globules that are yellow, ſerous, and ſix times leſs than the red; as alſo a tranſparent liquor that coagulates when expoſed to the fire; and a lighter thinner tranſparent water, conſiſting of ſtill leſſer parts, though not diſcernible by reaſon of their tranſparency. The maſs of the former ſort is called the red blood, of the latter the ſerum. Microſcopes ſhew us both.

Theſe particulars all depend upon the obſervation of Leeuwenhoeck; for the human blood inſpected through microſcopes appears to conſiſt of a great many ſpherical parts, ſwimming in a finer pellucid liquid, which by reaſon of its tranſparency eludes the ſight. When the motion of the blood is viewed through a microſcope in the tranſparent part of animals, it is plainly ſeen, that the larger particles of the blood are changing their figure every moment, when they are preſſed through the narrow paſſages of the veſſel, and meet with others, and conſequently that they are flexible. Theſe larger particles, according to the opinion of Leeuwenhoeck, are red globules, conſiſting of ſix ſmaller ones preſſed together; which ſmaller ones thus conſtituting a red globule by their union, would if ſeparated look yellow and be globules of ſerum. If the ſame analogy holds farther, theſe ſerous globules ſhould conſiſt of ſix leſſer ones, and this diviſion proceed even to the fineſt liquids that are ſecreted from the blood: but here our experience fails us, for whatever in the blood is more ſubtle than the red and ſerous parts is tranſparent. And yet as there is a moſt numerous ſeries of decreaſing veſſels from the aorta (which is the largeſt veſſel in the body) to the fineſt nerve, it is highly probable, that the humours which flow through each diſtinct ſeries are proportional to them. A congeries of the largeſt particles of the blood has the name of red blood; and all the other finer parts taken together conſtitute what is called the ſerum: for the blood when drawn out of the veſſels, ſpontaneouſly ſeparates itſelf into theſe two very diſtinct parts.

## SECT. XCIV.

THE red concreted maſs, if divided from the ſerum, and kept apart by itſelf, will ſoon, by the meer reſt and relaxation of its parts, reſolve in ſuch manner into ſerum, that very little of the red part ſhall be left remaining.

Let the vein of an healthy man be opened, and the blood that flows out will in a few minutes form itſelf into one red maſs; by degrees this red maſs ſhall contract; the thinner part ſeparating more and more every moment, and having for the moſt part the red concreted ſubſtance ſwimming within it; pour off this ſerum, and after ſome few hours the red ſubſtance ſhall leſſen, and a new quantity of ſerum be ſeen, 'till at laſt almoſt the whole of the red part ſhall be turned into ſerum. This ſhould be, according to Leeuwenhoeck's opinion, becauſe the red globules, conſiſting of ſix leſſer ones, being now freed from the preſſure of the veſſels, by degrees ſeparate into the ſerous globules, of which they were formed. Whence we ſee, how extremely difficult it is to fix the proportion there is between the red and ſerous parts of the blood, as the red part will by degrees be liquified into ſerum.

## SECT. XCV.

THE ſerum being long kept in an air moderately moiſt and warm, by the meer reſt and relaxation of its parts, will reſolve into a more thin, tranſparent, and light liquid, which by degrees will putrefy, and in great meaſure fly off in vapour. And theſe effects will be more or leſs in proportion to the time.

As the red part of the blood turns to a thinner ſerum, ſo will the ſerum, if left to itſelf, grow thinner, putrefy, and exhale, leaving only a few dregs behind. And as by being expoſed to a moderately moiſt and warm air, the ſerum ſhall thus grow thinner, ſo will it alſo become more acrid, and will not coagulate any more with boiling water or alcohol. The ſame particulars may alſo be obſerved in the white of an egg, for ſcarce any two liquids are found ſo much alike, as the ſerum of the blood and the white of an egg.

## SECT. XCVI.

ALL freſh blood (92), if expoſed to a gentle heat, ſcarce exceeding the warmth of a man in health, and with little loſs by exhalation, will run together into a ſolid, ſciſſile, tenacious maſs, indiſſoluble by water, oil, or ſpirit. And the ſame effect will follow, though the heat be communicated to it by moiſt bodies, through a ſingular kind of concretion reſembling the former.

The blood of an healthful perſon is very prone to concretion; the blood, which drops from a little ruptured artery in the noſtril, preſently runs together into a ſolid cake. But this proneneſs increaſes very much if the heat be increaſed; for augment it but to the tenth or twelfth degree of the Fahrenheitian thermometer above the natural heat of a man, and it will all run into a ſolid maſs. For which reaſon it is, that in acute diſeaſes there is ſo much danger from the increaſe of heat. When the blood is thus coagulated, it is very difficult to reſolve it; many things mixed with it may prevent it from being thus eaſily concreted; but when once the concretion is formed, neither ſalts, nor ſpirits, nor oils, nor even ſoapy ſubſtances, will be of much ſignification in our endeavours to reſolve it. The blood thus inſpiſſated by heat will liquify again by degrees in the open air, but then it will putrefy at the ſame time. Nor does this concretion ſeem to proceed from the diſſipation of its moſt ſubtle parts by heat, for if it be received from the vein in hot water it will immediately coagulate. The white of an egg, in like manner, preſently grows hard in boiling water, though its ſhell be unbroken.

## SECT. XCVII.

THE redneſs of the blood (93, 94), and the diſpoſition to coagulate in the ſerum and lymph (95, 96), is owing to the action of the veſſels, and the power of circulation; as we learn from the changes made in the nature of the chyle, milk, and blood, and microſcopes farther confirm to us.

It has been much diſputed, from whence the blood ſhould derive the wonderful properties abovementioned; and upon this occaſion many ſtrange ſuppoſitions have been advanced by philoſophers, and many idle notions by the chemiſts; while none of them were ever able by any eſſays of their art to form the leaſt drop of blood from the moſt nouriſhing food, it being the ſingular property of the human body alone, to produce the blood which it ſtands in need of out of matter, that is not blood. Nor does it ſignify whether a body be very ſmall, and almoſt in the firſt rudiments of its exiſtence, or already in an adult and firm ſtate; ſo inſeparable is actual exiſtence of blood from human nature, that it is found in the weakeſt infant as well as in the ſtrongeſt man; nay, there is even red blood to be ſeen in the human embyro, as ſoon as the embyro itſelf is capable of being diſcerned, and at the time, when there is not the leaſt appearance of it in the placenta, the membranes of the *ovum*, or the liquid contained within the ſaid membranes. So that we ſee the human body is capable of ſanguification even from the beginning, though in ſo tender and mucous a ſtate.

The time when the red blood is firſt produced in an human fœtus is not eaſily to be determined by experiments;

periments; but the immortal Malpighi has ſhewn it in a common egg. The fecundated egg of an hen before incubation ſhews not the leaſt appearance of any red blood, either in its ſhell, membranes, white, treddles, yelk, or in the *ſacculus colliquamenti,* though inſpected through the beſt microſcope.

But after incubation there was ſeen a change within almoſt every hour; and firſt round the ſpecks, near the yelk, were certain veſſels plainly diſcernible, which within a few hours were eaſily diſtinguiſhed from the contained liquid: in about thirty hours theſe veſſels were of a colour ſomewhat greeniſh; in forty hours they were of a ruſty colour, (what they call xerampeline, from the reſemblance it bears to the colour of a withered vine-leaf in autumn;) at the ſame time it was ſeen, that the congeries of veſſels that appeared in a cluſter before were collected into one, which tending toward the ſpeck ended in a ſinus, which then firſt became viſible; which ſinus, as afterwards appeared, proved to be the right auricle of the heart; in this ſinus, which hung down from the ſpeck, there was plainly to be diſcerned a manifeſt pulſation, and ſoon after a ſmall red point in the little pulſating body. After this the ſame redneſs appeared in the right ventricle of the heart, in the left ventricle, and ſoon after in a canal that ran lengthways along the ſpeck, which was the aorta. Whence we know, that red blood may be formed out of a ſubſtance which is not red, and even without the intermixture of any red blood before exiſting. Farther, the red blood has firſt its riſe in the little pulſating point, for it is firſt ſeen there, where the pulſation is, and is already red blood, before there is any redneſs ſeen in the rudiments of the chicken's liver; which abſolutely overturns the opinion of the Antients, who aſſign the office of ſanguification to the liver.

Perhaps too the air, without which no plant or animal can live, has a ſhare in this operation. For Malpighi (*a*) has obſerved, that after forty-eight hours incubation the treddle aſcends towards the obtuſe end of the egg, where the air is lodged. And the chyle in adult perſons, before it is changed into blood, flows through the lungs, where it is largely expoſed in very tender veſſels almoſt to the naked air itſelf. So in the opinion of the old alchemiſts, the air contained the hidden food of life.

In adult perſons likewiſe the blood is formed out of the aliments in a reſembling manner; for the lacteal veſſels draw in the chyle prepared in the inteſtines as the veſſels of the yelk do the *albumen* after it is attenuated by the heat of incubation; all the chyle meets in the thoracic duct; as in the young chicken all the veſſels meet in one within the amnion. Red blood is generated in the chicken by the heat of incubation, the motion of the humours through the veſſels, the power of the heart, and the action of the air in forty-eight hours; in an adult perſon human blood is formed from chyle in twenty-four hours, as appears by the obſervations of Lower and Walæus; and to this tranſmutation in an adult perſon the heat of the body, the action of the veſſels and the heart, and the power of the air in the lungs, applied to the chyle while it is flowing with the blood, all contribute; and that this is ſooner performed in a perſon grown up than in a young chicken, ſeems owing to the much ſtronger action of the veſſels on their liquids, to reſpiration, and the quantity of red blood that was in the body before.

In caſes where theſe cauſes are deficient, or act too ſlowly, what is produced is not red blood, but a degenerate liquor; as we have ſeen in girls that have the green-ſickneſs: for the blood, that is made in them is not red, but a kind of greeniſh colour ſpreads itſelf over the whole body like that in the veſſels of the yelk before the red blood was formed.

From

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(*a*) See for all this his tract *de ovo incubato*.

From hence we ſee, that the blood does not propagate itſelf by any ſeminal virtue, as ſome have imagined, but is formed out of a matter that before was not ſanguineous, and in a body which before had no blood in it; and as this was the caſe in the firſt dawnings of life, it continues the ſame unto the end.

While in a grown perſon the blood is forming from the chyle, it is obſerved to undergo various and ſucceſſive degrees of alteration: for preſently after eating, the chyle is found to run pure and unmixed with the blood in the veins, for which reaſon in the blood that is taken away after a large meal, beſides the ſerum and red part, there has been diſcovered a ſweet white chylous ſubſtance fluctuating in it.

After ſome hours the chyle circulating with the blood is ſeparated from it by the breaſts, and produces milk of a different nature both from the blood and chyle: for it begins here to aſſume that concreſcent quality which is diſcernible in the ſerum, as it will yield cheeſe, which the chyle never will; and thus we may by art come up to a reſemblance of chyle in emulſions, but never of milk.

If an healthy woman ſhall abſtain from all food for twelve hours, her milk will begin to be ſalt and yellowiſh: if longer, there will be nothing found in the blood but what will coagulate, when expoſed to the fire, like the white of an egg, which milk or chyle never does.

Whence we may reaſonably conclude, that the body of a ſound man is the ſole fabricator of its own blood, even as every plant forms its own juice by its own peculiar make, out of the juices of the fertile earth and the ſurrounding air.

The principal cauſe in the formation of the blood ſeems to conſiſt in the power of circulation, by which the veſſels act on their contained fluids: for which reaſon the blood of very ſtrong men is extremely red, ſo deep as to be almoſt black, and preſently coagulates the moment it is at reſt: ſo when the circulation is increaſed in acute diſeaſes, every part is red, and even the ſerum turns to a ſciſſile maſs: but in weak people, where the circulation is leſs, every part is languid and pale, and the blood hardly will coagulate at all; but when even in theſe the force of the circulation is increaſed by exerciſe and proper remedies, the redneſs ſhall return, and a due coheſion be reſtored to the blood.

## SECT. XCVIII.

THE increaſe of the motion of the blood through the veſſels, ariſes from the quicker and ſtronger contraction of the heart.

The nature of the blood being underſtood, the cauſe of its motion is next to be enquired into. This has been thought by many eminent men to have lain in the blood itſelf; for when they ſaw the mixing of two liquors together would excite very violent motions, they thought ſomething like this might take place in the blood. But if you receive the blood, as it ſprings from an artery burſting in the noſtril in the moſt violent fever, in a very clean veſſel, even though the veſſel were warm, this blood will immediately be ſtill, and not ſhew the leaſt ſign of any inteſtine motion; and therefore the cauſe of its motion is not in itſelf.

But the heart by its muſcular action throws the blood contained in its cavities with a very ſtrong force into the arteries, and theſe, when the action of the heart ceaſes, the next moment preſs it forwards by their elaſticity and muſcular force: and theſe are the true and only cauſes of the motion of the blood, which has its firſt riſe in the heart; for the arteries, when contracted to the laſt degree, would naturally reſt, if not dilated again by the blood that is thrown out of the heart. The muſcular action of the heart therefore gives motion to the blood; and when this ceaſes, an univerſal ſtagnation enſues.

If then the action of the heart, *i. e.* its contraction, (for in its diaſtole it acts not but is acted on), be more frequent and more ſtrong, the cauſe of the blood's motion will be increaſed; for it is not enough, that it contracts more frequently, (ſince at the approach of death, the contractions are ſo quick as not to be counted, at which time the circulation begins to fail, becauſe ſcarce any thing is thrown out of the heart), but it muſt alſo contract more ſtrongly, ſo as to throw out whatever is contained within its cavities: for that is a ſtrong contraction of the heart, which leaves the cavities empty, the weakeſt of all that which throws nothing out of them, and the intermediate degrees are the gradually weaker contractions.

## SECT. XCIX.

THE heart contracts oftener and ſtronger: 1. By the action of the cerebrum and cerebellum, when expreſſing too large a quantity of the nervous liquid, as in the affections of the mind, and in pain: 2. Through the irritation of the heart by the accelerated motion of the venal blood, driven forward by friction, or the action of the muſcles; or by ſome acrid matter mixing itſelf with the blood, whether of an aromatick, ſaline, acid, alcaline, purulent, ichoroſe, or putrid nature, and ſometimes by a ſpecies of contagion of a peſtilential or poiſonous kind, which ſort of evil has not hitherto been ſufficiently explained.

In this paragraph are conſidered the cauſes, which are found by obſervation to excite and increaſe the motion of the heart.

1. The heart has all the properties of a true muſcle, and is furniſhed with every part, which in other muſcles is inſervient to motion. When the nerve is

deſtroyed that leads to a muſcle, the action of that muſcle is deſtroyed: when the brain is compreſſed by the effuſion of any humour, the action of all the voluntary muſcles ceaſes: if there be a greater influx of ſpirits than ordinary through the nerves to any particular muſcle, from whatever cauſe it proceeds, the action of that muſcle ſhall be increaſed even to a violent ſpaſm. The heart abounds with large and numerous veins, and yet no acute ſenſe is raiſed in the heart by means of theſe nerves: the other muſcles of the body are wearied and pained by too much motion; but in acute fevers the heart is moved with great celerity for many days without the leaſt ſenſe of pain: ſo that theſe nerves ſeem to be ſubſervient to the motion of the heart. Now whatever can produce quicker motion of the ſpirits through the nerves of the heart, will increaſe the motion of the heart.

But this is wrought in a more eſpecial manner by the affections of the mind. All men are ſenſible of this truth, but no one has yet explained by what means it is performed. Offer an affront to a man who is now quite calm and undiſturbed, and on a ſudden, by a change in his thoughts, an univerſal change ſhall ariſe in the whole ſyſtem; his heart beats quicker and ſtronger, his pulſe riſes higher and fuller, he grows hotter, his face ſwells, his eyes ſparkle, and even a violent fever will ſometimes follow, that ſhall end in death.

Pain will alſo ſo change the whole brain as to cauſe a delirium, and ſo take away the ſenſe of pain, or even a perfect ſyncope; which is the utmoſt that the ſharpeſt torments can effect. As therefore pain can ſo affect the common ſenſorium, well may it affect the nerves which proceed from thence. Pain ſeldom continues long, but it cauſes a fever, (*i. e.* a quicker contraction of the heart), and even in ſuch diſeaſes as are moſt remote from a fever, ſuch as the gout. So that Galen has well obſerved (*a*), *Dolor dum parvus eſt*,

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(*a*) Gal. de pulſibus ad tyrones, cap. XII. Chart. Tom. VIII. p. 8.

*eſt, atque initio, pulſum edit majorem, vehementiorem, celeriorem, crebriorum; auctus verò jam & admodum validus, ut etiam vitale robur offendat, minorem, languidiorem, celeriorem, crebriorem:* “When pain is little and in its beginning, it occaſions the pulſe to be higher, more vehement, ſwift, and frequent; but when it is increaſed and grown very great, ſo as to offend even the vital powers, it makes it leſs and more languid, but ſwift and frequent.”

2. By the irritation of the heart.] Beſides the common cauſes of motion in other muſcles, the heart has a ſingular property, that may be called its irritability; for when the influx of the ſpirits by the nerves into the *villi* of the heart, and the motion of the arterial blood through its ſubſtance, ſhall ceaſe by death, its motion may be revived by wind or warm water blown through the veins; and even when cut off from all the veſſels to which it adheres, it ſhall ſtill preſerve its motion for ſome conſiderable time; and though after this it lies quiet for many hours, if it be pricked with a needle and made moderately warm, it ſhall again begin to move. Phyſiologiſts have been very curious in their explications, why the heart ſhould alternately become paralytic, and in an inſtant, almoſt as quick as lightning, be again convulſed with a kind of ſpaſm; and how the cauſe, which produces the ſyſtole, ſhould every moment ceaſe, and be the next renewed; and this they have deduced from the ſtructure and ſituation of the parts: and yet the heart, when taken out of the body, ſhall continue the ſame motion, though adhering no longer to any part, and this frequently too for a conſiderable time. See §. 1.

Of the venal blood.] When a young perſon falls into a ſyncope through paſſion, or the ſight of any frightful object, the heart ceaſes to move; throw cold water on the naked body, and the parts contracted by cold ſhall propel the venal blood towards the heart and renew its motion. when the ſoul of Sarpedon wounded and fainting ſeemed diſpoſed to leave him, the breath of Boreas, contracting his veins by the coldneſs of the blaſt, recalled his ſpirit and reſtored him (*b*); whatever cauſes the venal blood to move more ſwiftly towards the heart, increaſes the motion of the heart; and thus a very high fever may be raiſed by too violent muſcular motion, or by violent frictions. See §. 28. numb. 2.

Or by an acrid in the blood, *&c.*] Our humours in health are mild, (for the blood of a ſound perſon dropt into the eye gives no pain) and the circulation is then moſt equable; but as ſoon as any thing acrid is mixed with the blood, the motion of the blood through the veſſels is increaſed by the irritation of the heart, and a fever raiſed, which either expels the ſharpneſs, or ſubdues it to ſuch a degree, as to hinder it from doing any farther miſchief: nor does it much ſignify what the acrimony is, as to the effect; acrimonious ſubſtances differ only in a greater or leſs degree and a more or leſs durable action. In ſpicy ſubſtances the acrid part included in a tenacious oil is ſo cloſely united, that it cannot eaſily be disjoined; and thus when a large doſe of beaten pepper is unadviſedly taken to cure an intermitting fever, a mild tertian ſhall by this means be ſometimes changed into a continual fever. If a man eat too great a quantity of ſalt at his dinner, he ſhall be feveriſh and thirſty in the afternoon, 'till by drinking freely he ſhall carry it off. Vinegar itſelf, which is of ſo much uſe in putrid fevers, if taken down in too large a quantity, ſhall raiſe a fever. If from an internal abſceſs purulent matter ſhall be collected, and this be again abſorbed and mixed with the blood, it ſhall bring on an hectic fever every day, that ſhall by degrees prey upon the whole body; and if the pus by long retention ſhall turn to ichor, it will then become acrid, and being licked up by the veſſels ſhall cauſe ſtill greater miſchief.

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(*b*) Hom. Iliad. Lib. V. ver. 95.

Corrupted bile lying near the region of the ſtomach, or the putrid matter formed in a conſumed liver, ſhall raiſe ſuch enormous fevers as can never be cured, 'till the putrid cauſe be removed.

In all theſe caſes the acrimony is viſible to the ſenſe; but there are other moſt ſurpriſing *ſtimuli*, which cannot be reduced to any known ſort of acrimony, and yet diſorder the whole ſyſtem of the body in all its ſeveral functions.

The contagion of the ſmall-pox ſeizes a man in perfect health with an infection, that eludes the ſenſes: a very violent fever riſes upon it, that in a few days overſpreads the body both outwardly and inwardly with variolous pus; and in this pus, though formed by the diſeaſe from the ſoundeſt humours, there reſides the ſame power of propagating the contagion *in infinitum*; as is plain from inoculation, which is performed by dropping a very ſmall portion of the variolous matter into a freſh wound. Who now can be able to explain the nature of this ſtimulus? Or who will point out to us the manner how ſound humours, changed by the variolous contagion, ſhall aſſume a poiſonous nature, and at the ſame time acquire almoſt an infinite power of multiplying the poiſon?

Every ſort of animals is liable to a particular plague, which ſeldom affects others. When the plague raged among the oxen throughout all Europe, the men were free from the contagion, and even thoſe that eat of their infected fleſh. The moſt eminent Phyſicians, who ſought by diligent enquiry to find out the nature of this dreadful diſtemper, acknowledged, that all their ſkill was unable to penetrate into the cauſes of it, nor could they otherwiſe underſtand it, than by its effects. The peſtilential poiſon, which lies unactive, though ſo cloſely adhering to wool, ſilk, linen, or to ſpungy and porous wood, when applied to the body of a man, becomes active, and multiplying the contagion ſpreads itſelf far and wide; and then how ſtrangely it diſorders the whole fabric, and what violent fevers are raiſed by it, *&c.* may be ſeen in Diemerbroeck and other writers upon the plague.

The ſurpriſing hiſtory of poiſon ſhews us, that there are ſuch ſtimuli in the poiſonous liquors of animals, as have no acrimony diſcernible by the ſenſes, and which yet immediately diſorder almoſt every function, and raiſe the moſt violent fevers. Of this the poiſon of the viper will ſerve for an example. Charas relying on the obſervations and honeſty of the very noble Redi, taſted the yellow liquid that lies near the jaw of the viper, and found its taſte to reſemble that of the oil of ſweet almonds (*c*) : whilſt the ſmalleſt quantity of the ſame liquid, infuſed into a little wound made by the bite of the ſame animal in a gentleman careleſsly handling it, within a few minutes brought on the moſt violent ſymptoms, inſomuch that he hardly eſcaped with life, though all means were uſed cure him (*d*).

## SECT. C.

THE effects of the increaſed motion of the blood, are a more forcible action on the veſſels that receive it; a greater re-action of the veſſels on the blood; a ſtrong compreſſion of the blood; a violent attrition of the veſſels and blood againſt each other, and of the parts of the blood with themſelves; a greater heat of the whole; an exſiccation of the blood by the diſſipation of its watery parts; its inflammatory viſcoſity and eaſy concretion; the reſolution of the blood into ſharper ſalts and more volatile and acrid oils; the enlarging the mouth of the veſſels; the forcing of the thicker liquids into the ſmalleſt veſſels, their obſtruction and deſtruction, inflammations, ſuppurations,

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(*c*) Moſis Charas Oper. Tom. III. pag. 138.

(*d*) Ibid. pag. 156.

ſuppurations, gangrenes, ſphacelus's and ſchirrus's; together with the numberleſs conſequences which may follow thereupon,

You have here the effects depending upon the increaſed motion of the blood, which have been obſerved both in the ſolid and fluid parts of the body.

A more forcible action on the veſſels that receive it.] The arteries are always full, and conſequently muſt be dilated when the heart throws out the blood contained within its cavities; or at leaſt ſo much muſt paſs through the extremities of the arteries as is received by them from the heart: but all the arteries of the body (except the coronary arteries) are dilated in the very moment that the heart is contracted; the action of the heart therefore is almoſt wholly ſpent upon dilating the arteries, by which means their ſides are forced to recede from their axis, and all the fibres conſtituting the ſaid ſides are diſtended. And ſince an increaſed motion of the blood, as was proved §. 98. muſt ariſe from the more frequent and violent contraction of the heart, it is plain likewiſe, that the force, by which the ſides of the arteries are compelled to recede from their axis, muſt be increaſed in a proportion compounded of the increaſed ſtrength and frequency of the contractions of the heart.

Greater re-action of the veſſels on the blood.] The arteries when they are diſtended are in a violent ſtate, and hence their ſides endeavour to approach nearer to their axis by their elaſticity and muſcular action; and ſo repreſs the diſtending blood; for unleſs the arteries by being contracted through their own ſpring were to expel the blood which diſtends them, the heart would not be able the next ſyſtole to throw the blood contained in its cavities into the arteries that are already diſtended; and conſequently the blood would by degrees be accumulated within its cavities, and the circulation ſtopped. The ſtronger therefore the action of the heart is, which diſtends the arteries, the greater will the power of that force be, by which the arteries endeavour to contract their cavities; and the oftener the heart is contracted in the ſame ſpace of time, the more frequently will the contracted arteries re-act upon the blood that diſtends them.

Strong compreſſion of the blood.] The blood in the arteries is as it were between two preſſes; when they are dilated, the impelling force of the heart drives the blood from the baſis of the artery to the apex, in the mean while as the extremities of the arteries are very narrow, they cannot but make a very great reſiſtance: when the arteries contract, the valves at their baſis in the heart reſiſt its return, whilſt the ſame reſiſtance alſo remains at their extremities as before; ſo that in both caſes the blood in the arteries is compreſſed. But as the conſtituent parts of the blood are flexible and compreſſible, as we have already obſerved in §. 93. if the compreſſing cauſes, which are the actions of the heart and arteries, be increaſed, it will certainly follow, that the compreſſion of the blood muſt of neceſſity be greater.

The violent attrition of the veſſels and blood againſt each other, and of the parts of the blood with themſelves.] When the blood is driven from the heart, and ſtrikes againſt the ſides of the incurvated aorta, this direction of the blood is reſiſted by the firm ſides of the aorta, and the blood which is contained within its cavity; ſo that not a particle of blood thrown from the heart into the aorta will move in the ſame direction for two moments, that it had when it iſſued from the heart: add to this, that as the aorta is a cone which is broadeſt near the baſis, and grows narrower as it lengthens, and the direction of the motion of the blood thrown from the heart is in lines perpendicular to its baſis, particles of this blood muſt of neceſſity ſoon ſtrike againſt the ſides of this canal, and in their rebound meet with other particles in a contrary direction; from whence will of neceſſity ariſe a continual attrition of the particles of the blood both with each other, and with the ſides of the veſſel; by which means, as the particles of the blood are flexible, their points will be broke off by this perpetual attrition, and they will acquire a ſpherical figure: and if this motion of the blood be increaſed, this attrition will be increaſed in like proportion.

Greater heat of the whole.] Heat ariſes from the attrition of the parts with each other, and the ſides of the veſſels. This is certain beyond all doubt, becauſe as ſoon as the blood is at reſt, all heat ceaſes, and the body returns by degrees to the coldneſs of the ſurrounding atmoſphere. When the motion of the blood is increaſed by ſtrong exerciſe or a fever, the heat increaſes too; but weak people, in whom the circulation is languid, are always cold.

It is a true ſaying therefore of Hippocrates, that *ſanguis non eſt natura calidus, ſed caleſcit*; "blood is not "hot by nature, but grows hot (*e*)."

The exſiccation of the blood by the diſſipation of its watery particles.] Heat if increaſed will always diſperſe the moſt moveable parts. The whole body has exhaling veſſels in every branch of its ſurface both outwardly and inwardly, by which the thinneſt part of the blood is ſeparated from the reſt, and carried off. The more frequently therefore the blood is brought to theſe organs, the greater will the ſeparation be. For which reaſon in all diſeaſes, where the heat is increaſed, the body is dried. And therefore Hippocrates has obſerved (*f*): *quicunque vero ex febre ardente moriuntur, omnes ex ſiccitate pereunt*; "they who "die of a burning fever die of dryneſs."

Its inflammatory viſcoſity.] The blood of the moſt healthful man is naturally inclined to coagulate as ſoon as it is out of the veſſel. This quality is increaſed by greater heat, the loſs of the watery parts, and the increaſe of the compreſſing powers. We have already ſhewn, that the watery part is carried off,

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(*e*) In fine libelli de corde. Charter. Tom. IV. pag. 271.

(*f*) In fine libri primi de morbis. Charter. Tom. VII. pag. 549.

off, and the heat increaſed, by an increaſe of the blood's motion. But the action of the veſſels upon the blood is a true compreſſion of the blood they contain, and therefore as this action of the veſſels is increaſed, when the blood moves with a quicker motion, it is plain, that in this all the cauſes concur, which are apt to make it coagulate. This produces the Phlegma Phlegmonodes of the Antients, ſo very different from a cold mucous concretion: it is now called likewiſe an inflammatory ſpiſſitude, ariſing from the violent compreſſion of the elementary particles of the blood againſt each other. Theſe elementary particles are obſerved to be ſpherical or nearly approaching to this figure, and for this reaſon they muſt have very few points of contact; but when their figure is changed by violent preſſure, and the thin watery parts lying between are expreſſed, the elementary particles muſt then touch each other in a greater number of points and run into concretions; and hence ariſes that ſizy ſtiffneſs reſembling leather, which is ſeen in the blood of pleuritical perſons.

The reſolution of the blood into more volatile and acrid ſalts and oils.] The beſt ſpecimen of the ſtate of the ſalts and oils of the blood is in the urine, for that is the true lixivium of the blood, or the ablution of all the ſalts and oils that were growing too acrid, and would thereby do hurt. It is very clear, that the urine grows more acrid and fetid as the circulation is more violent: in weaker people it is pale, without ſmell, and not very ſalt to the taſte; in ſtrong perſons accuſtomed to exerciſe it is more red and fetid, and very ſalt. If therefore the motion of the blood through the veſſels be increaſed, it will make the ſalts of the blood to become more acrid and volatile, the oils alſo will grow thinner and be leſs mild: theſe again will form a freſh ſtimulus to increaſe the circulation, from the increaſe whereof they deduced their origin; and the effect of a diſeaſe will increaſe the diſeaſe itſelf.

The enlarging of the orifices of the veſſels.] The force of the heart, which propels the blood into the arteries already full, is the only cauſe that dilates the arteries; as therefore this action of the heart increaſes, in like manner will that dilatation of the arteries be increaſed. But the dilatation will be greater, the nearer the artery is to the heart; and conſequently the parts which lie neareſt the mouths of the arteries will be the more dilated, as the force of this dilating power cannot poſſibly extend to the other extremities of the arteries with a like effect.

The forcing of the thicker liquids into the ſmall veſſels.] A red globule is found to be the largeſt particle of the blood, which naturally can be contained in the largeſt veſſels only; the next particle to this in ſize is that which will enter a leſſer veſſel, that by reaſon of its ſmallneſs will not admit of a red globule, but gives a paſſage to every particle that is leſs. The ſame obſervation holds good in the other decreaſing ſeries of veſſels; and health ſeems in a great meaſure to conſiſt in this, that every veſſel contains its own proportional liquid. But when by the increaſed motion of the blood, the entrances of the arteries of a decreaſing ſeries are enlarged, the groſſer particles will thereby gain admittance into veſſels, which naturally ought not to contain them. Thus when the entrance of an artery, (ſpringing from an artery that carries red blood) through which there ought only to flow a ſerous liquid, is dilated, the red blood ſhall enter this ſerous artery. And this we have confirmed to us by the moſt certain obſervations. If a man in health runs violently, his face ſhall begin to ſwell, and grow red in ſuch places as naturally are not apt to be red, the *tunica adnata* of the eyes ſhall have its veſſels filled with red blood, whereas naturally theſe veſſels have no red blood in them at all. After violent motion, or being hurried in a coach through rough ways, the venal tubes ſhall dilate, and give a paſſage to the blood, from whence ſhall proceed bloody urine, which meer reſt will eaſily cure.

Their obſtruction and deſtruction.] An artery grows gradually narrower in its courſe, 'till at length it becomes ſo ſmall as to tranſmit only one particle of blood at a time. This appears to the eye in the tranſparent parts of living animals when viewed with a microſcope, and more particularly in the lungs of a lizard, when drawn through an orifice made by inciſion; for in this caſe the microſcope plainly ſhews, that at the narrow ends of the arteries, each little globule of the liquid paſſing through them is changed into an oblong cylindrick form, and ſo preſſed through. When therefore a dilated ſerous artery ſhall in its entrance happen to admit a particle of red blood, this particle will not be able to paſs through the narroweſt end of it; in conſequence whereof the pipe will be obſtructed, and then by the continual motion of the liquids preſſing againſt the obſtructed part, the ſmall veſſel will be eaſily deſtroyed.

Inflammations, *&c.*] When the red blood ſtagnating in the ſmaller veſſels is compreſſed by the impetus of the blood lying behind, which likewiſe moves with the greater celerity, by reaſon of the fever that commonly attends it, it is called an inflammation; which therefore moſt frequently ariſes from the paſſage of the thicker liquids into the dilated leſſer veſſels. And when an inflammation is once formed, the ſeveral effects of it follow: for when the obſtructed veſſels, together with the unpaſſable humours impacted in them, are acted upon by the vital powers, 'till they are at length turned into a thick white uniform humour called pus, there is then formed a ſuppuration. But if all circulation of the vital humours, through the part affected, be cut off by the ſudden breaking of the veſſels, there follows a gangrene or death of the part; which miſchief, if it extends to the corruption of every part quite down to the bone, is called a ſphacelus. But if the inflammation be near ſome glandular part, it often ends in a hard ſenſeleſs tumour very difficult to be reſolved, called a ſchirrhus.

If what has been ſaid in this paragraph be duly conſidered, it will plainly appear, that numberleſs diſeaſes may ariſe merely from the increaſe of the circulation. Every humour in the body may acquire a morbid nature by too much motion and heat, producing a greater preſſure, a conſumption of the watery part, coagulation, and acrimony. The ſolids are hereby ſubject to a greater attrition, and are frequently broken ; and the dilated veſſels become liable to receive ſuch humours as are too groſs to paſs through them. And if at the ſame time it be conſidered, that this may happen both in all the parts of the body together, and in every diſtinct part of it ſeparately, it will plainly be ſeen, that numberleſs diſeaſes may ariſe from this ſimple cauſe.

## SECT. CI.

AN increaſed circulation therefore is known from its known cauſes (99), and effects (100) ; but eſpecially by a quick and hard pulſe, by a ſhort and difficult reſpiration, and great heat.

It is of the greateſt uſe in phyſick to know, whether the diſtemper be owing to too great a velocity in the circulation, or not. If the cauſes of the increaſed circulation, are to be ſeen, and there be any diſcernible effects of the violent motion, there is no room left to doubt of it ; in the mean time there are ſome never-failing ſigns, which plainly point out an exceſs of the circulatory motion.

Quick and hard pulſe.] The quickneſs of the pulſe hews, that the heart is contracted more frequently han it ſhould be in the ſame ſpace of time ; its hardneſs points out the fulneſs of the arteries, that the blood is very compact and denſe, and that with difficulty it gains a paſſage through the minute veſſels by means of its inflammatory viſcoſity. The meer quickneſs of the pulſe ſhews only that the heart is contracted more frequently, but not more ſtrongly: for near death the pulſe is quicker than ever, but at the ſame time very ſmall. The hardneſs of the pulſe without its being quick, denotes rather a ſtoppage of the circulation, as is the caſe of very plethorick perſons.

Short and difficult reſpiration.] All the blood thrown out of the right ventricle of the heart ought to paſs through the lungs before it can return into the left; but as the right ventricle would not ſuffice to propel all the blood through the narrow paſſages of the pulmonary artery by its own muſcular force alone, there is farther required the concurring action of inſpiration to dilate the lungs, and thereby open a free paſſage to the blood that is thrown from the heart. In proportion therefore as the right ventricle of the heart in a given time contracts oftener and ſtronger, ſo much the more frequent and more ſtrong the inſpiration is required to be. Thus we ſee, that whenever the motion of the blood is increaſed by running or any other exerciſe, the reſpiration increaſes in proportion, and is performed with greater difficulty. And thus the reſpiration is greater merely from an increaſe of the velocity of the blood, which paſſes through the lungs: but when beſides this, through the greater motion the blood begins to aſſume an inflammatory ſpiſſitude, the reſpiration will then be much quicker and more difficult; for this ill quality in the blood, of its not being able to paſs, firſt ſhews itſelf in the lungs; and for this reaſon, in acute inflammatory diſeaſes, a ſhort and difficult reſpiration is looked upon as ſo ill a ſymptom.

Great heat.] So long as there is a free courſe through the veſſels, whilſt the ſwiftneſs of the motion increaſes, there is alſo an increaſe of heat. But when the blood becomes ſo impermeable, as not to be able to reach to the extreme parts, theſe ſhall grow cold, whilſt there remains a burning heat within; as is the caſe in very bad continual fevers; for which reaſon it is reckoned among the ſymptoms preceding death by Hippocrates, in his Prognoſticks, and elſewhere.

## SECT. CII.

SUCH remedies therefore as are of efficacy in reſtraining too violent motion, will alſo be of ſervice to leſſen the too frequent and forcible contraction of the heart.

Theſe ſimple diſeaſes ought firſt to be conſidered apart by themſelves; here therefore is ſuppoſed no other change in the body, but an increaſe of the circulation only. The remedy therefore will be, whatever takes away the proximate cauſe of that increaſed motion; *i. e.* the too quick and ſtrong contraction of the heart; *i. e.* whatever makes it move ſlower and weaker. Now ſuch a remedy muſt act either on the ſpirits that move the heart, or on the arterial and venal blood, that more immediately belongs to the ſubſtance of the heart; or, laſtly, on thoſe ſtimuli, which by their irritation cauſe the heart to be quicker and ſtronger.

## SECT. CIII.

OF which ſome relate to the mind, others to the body.

It has been obſerved §. 99. that a change of the thoughts only in the ſoundeſt body may ſo increaſe the motion of the heart, as to bring on a very violent fever; and unleſs a Phyſician be able to remove this change in the thoughts, other means will be all ineffectual. And whatever does this without changing the body, acts on the mind. When a very angry man is put into a very great fright, his anger is aſſwaged by this change in his thoughts, though no alteration be wrought in his body. The other means that take away the corporeal cauſes of increaſed motion, act on the body only.

## SECT. CIV.

OF the former ſort are ſuch as will aſſwage any great paſſion by reaſoning, by exciting a contrary paſſion or diverting it.

By reaſoning.] We find in ourſelves, that we think, and that the things we think of are different from our thoughts, and which, if they are objects, that merely employ the underſtanding, do but little affect us, and only hold us in contemplation: this we ſee in ſome conſiderable mathematicians, who thus ſpend their whole time in the exeriſe of their thoughts, and are little affected by any objects beſides: we have farther another kind of perception, which we cannot eaſily communicate to others, though it be more clearly and ſtrongly perceived by us, than even truth itſelf. Thus when we taſte any pleaſant wine, it raiſes in us an idea which we cannot explain, but only by ſaying, that we are pleaſed with it; and yet this pleaſing ſenſation is as manifeſt, and as ſtrongly affects us, as the moſt powerful truth can do. Let a man taſte of a rotten egg, and it will raiſe in him ſuch an abhorrence, that he will not be prevailed upon on any terms to taſte it again. Thus the paſſions riſing with their proper perception, hurry away the mind by an almoſt inevitable neceſſity to aim at the continuance of that which pleaſes, and the removal or deſtruction of that which diſpleaſes.

Now this pleaſing or diſpleaſing ſomething which accompanies an idea, is diſtinct both from that idea and the thinking principles; and yet it diſorders every idea, and takes away, as it were, even the will and liberty itſelf, compelling us to deſire or averſion ; for which cauſe theſe ſenſations have been called the affections or paſſions of the mind, and not without reaſon, as we are not their maſters but their obſequious ſlaves ; ſince we very often ſee and approve the better part, yet unwillingly, as it were, take up with the worſt.

When the pride of the philoſophers endeavoured to annul that pleaſure and pain accompanying the perception of our ideas, how greatly did they err ! The whole that the condition of humanity admits of is, that we govern our paſſions by reaſon : but this is often found too weak to break theſe ſtrong ties. So that we are obliged to uſe our utmoſt endeavours in continuing the ſtruggle, 'till reaſon grow ſtronger and triumph ; and, in truth, the wiſeſt of mankind, with all the aſſiſtances of reaſon and religion, are ſcarce able to maintain their ground againſt the violence of their paſſions.

Exciting the contrary affections.] The moſt prudent law-givers, as well knowing that human ſociety is not to be ſupported by reaſon only, have therefore conſtituted rewards and puniſhments. The fear of puniſhment may reſtrain a man raging with anger, in a caſe where the wiſeſt precepts of morality ſhall be of no force. It is therefore a circumſtance of great advantage to know what affections are oppoſite to each other. Great fear ſuppreſſes anger ; and the moſt timorous man grows bold when angry. If the changes produced by theſe two paſſions in the body be obſerved, they will be found quite oppoſite.

In an angry man the heart immediately beats quicker and more forcibly ; the pulſe is fuller, ſtronger, and ſwifter ; every part ſwells and grows broader, let the man be ever ſo lean ; a greater heat overſpreads the whole body, almoſt every muſcle is extended, the eyes ſtart out of their ſockets, and look fierce and ſparkling, and charged with blood, and this fury farther vents itſelf in violent threatenings and reproaches, *&c.*

Homer, who in all caſes has ſo well copied after nature, compares the eyes of Agamemnon, when angry, to a flame (*a*). When Achilles was angry, becauſe his miſtreſs was taken from him by force, his eyes ſhone terribly (*b*); and when Ajax perſwades him to take arms again, he replies, "My heart ſwells with "anger (*c*):" when he ſaw his arms brought him by Thetis, preſently "his heart glows with rage, and "flames of fire flaſhed from his eye-balls (*d*)."

On the contrary, a man ſtruck with ſudden terror, grows pale and cold, ſhrinks in every part of the body, his pulſe is quick but low and unequal, the heart palpitates, the lungs are oppreſſed, and ſobs and ſighings follow; his ſtrength fails him, his whole body trembles, or, as it ſometimes happens, grows ſtiff like a ſtatue, and his tongue cleaves to the roof of his mouth. For which reaſon Homer calls fear cold (*e*), and elſewhere ſpeaks of pale fear (*f*); thus when Paris fled from Menelaus, "trembling ſeized his limbs, he "fell backwards, and his cheeks turned pale (*g*);" and ſo in many other places.

Thus do contrary paſſions produce oppoſite effects in the body, and one affection of the mind may be a cure for another. The ſame might be ſhewn of the other oppoſite paſſions; but this one inſtance may ſuffice for an example.

Or by diverting it.] There is this wonderful property in our minds, that we can join the ideas we think of to certain arbitrary ſigns, between which ſigns and the ideas there is not the leaſt ſimilitude, and yet the ſight of theſe ſigns ſhall preſent the idea to the mind. A few letters joined together ſhall raiſe an idea, which we have formerly had many years ago, and which we ſhould never have recollected, had not theſe arbitrary ſigns preſerved it for us. And

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(*a*) Iliad. Lib. I. pag. 7. (*b*) Id. pag. 11. (*c*) Il. Lib. IX. pag. 171. (*d*) Il. Lib. XIX. pag. 346. (*e*) Il. Lib. IX. pag. 149. (*f*) Il. Lib. XIV. pag. 272. (*g*) Il. Lib. III. pag. 50.

And the caſe is the ſame with regard to the affections of the mind; when Æneas was about to yield to the entreaties of Turnus, caſting his eyes upon the belt of Pallas whom Turnus had ſlain (*h*).

*——————furiis accenſus, & ira*
*Terribilis: Tune hinc ſpoliis indute meorum*
*Eripiere mihi! Pallas te hoc vulnere, Pallas*
*Immolat, & pœnam ſcelerato ex ſanguine ſumit, &c.*

When caſting down a caſual glance, he ſpy'd
The golden belt that glitter'd on his ſide:
The fatal ſpoils, which haughty Turnus tore
From dying Pallas, and in triumph wore.
Then rouz'd anew to wrath he loudly cries,
(Flames, while he ſpoke, came flaſhing from his eyes:)
Traytor, doſt thou, doſt thou, to grace pretend,
Clad, as thou art, in trophies of my friend?
To his ſad ſoul a grateful off'ring go;
'Tis Pallas, Pallas, gives this deadly blow.
He rais'd his arm aloft; and at the word,
Deep in his boſom drove the ſhining ſword.
The ſtreaming blood diſtain'd his arms around,
And the diſdainful ſoul came ruſhing thro' the wound.

Whether it be an agreeable or diſagreeable ſenſation that attends the recollection of an idea, the paſſions revive the more keenly, and thus may at length become perpetual; then that power of thinking, which the mind before could extend to infinite objects, all periſhes, and is wholly converted into this ſingle paſſion, and the will, whoſe power was infinite before, now wills but one thing only; this is called a delirium; or if it be attended with an exceſſive violence, it is termed raving; if with a fever and agitation of the humours, it is named a phrenſy; if it be without any of theſe, a mania; if at the ſame time there be a total neglect of all things whatſoever, it is called folly or idiocy.

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(*h*) Virgil. Æneid. Lib. XII. at the end.

For this reaſon a prudent Phyſician endeavours, unknown to his patient, to remove all thoſe objects, which may revive that idea, either by ſenſation or recollection: and ſets before him whatever may excite a different idea, in order by degrees to diminiſh or deſtroy the former too violent impreſſion; and this is called to divert the thought. And it is enough for this purpoſe, if by any means the thought can be ſo changed, that the ſame idea may not by its long poſſeſſion occupy the whole mind, and at length become indelible.

But in caſe that violent paſſions ſhall diſorder the whole frame, and irritate every branch of the nervous ſyſtem, as often happens in hyſterick perſons, we then are forced to have recourſe to ſuch medicines as ſhall calm the ſpirits, and ſilence the action of the brain entirely for a ſeaſon. Such a remedy we have in the juice of the poppy, which though taken in a ſmall doſe, ſhall bring on the moſt agreeable ſenſation that can be, and like Helena's Nepenthe, make us forget all our ſorrows; in a larger doſe, it cauſes ſleep, and if given in too great a quantity will at laſt occaſion an apoplexy. So wine, to a man not much accuſtomed to drink it, will produce a reſembling effect; it will firſt make him chearful, then calm and compoſed, and at laſt lay him to ſleep, and give him the reſt he deſires from all his troubles.

## SECT. CV.

THE latter act by giving reſt to the muſcles, relaxing the veins, (54), making milder whatever is acrid, either by diluting or blunting (66, 67, 68), and by taking away the cauſes of pain.

The remedies preſcribed in the laſt paragraph were deſigned to reſtrain thoſe impetuous motions, which were the effects of a change in thought, by acting on the mind rather than the body: what follows will take away the corporeal cauſes of an increaſed motion.

By giving reſt to the muſcles.] The influx of the venal blood into the cavities of the heart was reckoned §. 25. numb. 2. and §. 28. numb. 2. among the cauſes of the motion of the heart; now the motion of the venal blood is accelerated by the motion of the muſcles; for moſt of the veins on the ſurface of the body lying on the muſcles, are compreſſed by them when they are in action, and the blood is thereby thrown forward toward the heart, as the direction of the motion of the blood that flows in the veins is from the apex to the baſis. Beſides, when the muſcles are in action, they look pale, the blood being expreſſed, and of courſe returns more ſpeedily by the veins to the heart; and thus it is, that the motion of the blood is ſo much increaſed by muſcular motion. This is well known to the ſurgeons, who when the blood flows too ſlowly from a vein which they have opened in the arm, direct the patient to move his fingers, and preſently it flows faſter. And hence the Phyſiians of old, though unacquainted with the circulation, in all diſeaſes, wherein there was too much motion, enjoined the moſt abſolute reſt, removed every object that might affect the ſenſes, and kept their patients in darkneſs, at a diſtance from all noiſe and diſturbance.

Relaxing the veins.] It is always obſerved, that in the moſt acute diſeaſes, where the circulation is quickeſt, the greateſt quantity of the blood lies in the arteries, and the veins are empty: on the contrary in languid diſeaſes, where the circulation fails, the veins and all the cavities of the body are full, and the arteries empty: the relaxation and fullneſs of the veins therefore accompany a diminiſhed circulation. But beſides, when the veins are relaxed, as they are capable of being diſtended by the blood iſſuing from the arteries, they will contain a greater quantity of blood, and conſequently a leſſer quantity of blood is returned to the heart; one of the chief cauſes therefore of its motion is of courſe diminiſhed: at the ſame time the impetus of the blood flowing from the arteries to the veins is retarded, becauſe of the greater maſs to be moved which it meets with in the veins; and on both accounts the velocity of the circulation muſt be diminiſhed.

But we have already pointed out the method, §. 54. how the veins may be relaxed; the beſt means of all is a vapour-bath applied externally to the ſurface of the body: and at the ſame time doing the ſame thing internally by the adminiſtration of clyſters, giving to drink emollient decoctions, and preſcribing a reſembling diet. This was the method which Hippocrates conſtantly purſued in his treatment of acute diſeaſes.

By making milder whatever is acrid.] Every thing known to be acrid, to what claſs ſoever it belongs, is capable of being cured by art, provided the viſcera be yet ſound. An acid, alcaline, or aromatick acrimony is eaſily corrected; but when thoſe ſurpriſing poiſonous ſtimuli, thoſe contagious taints, that are not to be diſcovered by ſenſe, and are only known by their effects, are the cauſes of producing an increaſed motion, art ceaſes to be ſucceſsful. A girl bit by that moſt venomous ſerpent, called from the rattle in its tail the rattle-ſnake, ſoon died, and though a Phyſician was preſent, he was not able to give her any aſſiſtance; and within a few hours after, when ſhe was going to be diſſected, the fleſh fell off from her bones in a putrid ſtate (*a*). When the moſt healthy man is infected with the contagion of the ſmall-pox, which is ſo ſubtle as to eſcape all notice of the ſenſes, the whole frame is thrown into diſorder, and a violent fever enſues, which changes all the humours ſo ſtrangely, that in fourteen days time the body both within and without is overſpread with a gangrenous corruption.

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(*a*) Journal des obſervat. phyſiq. mathemat. & botaniq. par le R. P. Louis Fouillée, Tom. I. pag. 417.

corruption. If this ſtimulus could be deſtroyed at the firſt coming on of the diſeaſe, no miſchief would afterwards follow. This is that divine part (τὸ θεῖον) in diſeaſes that ſo often eludes the power of art, and is the reaſon why Phyſicians ſo often fail in their attempts to reſtrain an increaſed motion, when too great. All that art can do is to weaken life, which makes the poiſon active, (for poiſons are not capable of producing any effect on a dead body) and then by pouring down large quantities of diluting drinks to waſh them away; and at the ſame time to blunt their edges by giving plentifully whatever is moſt emollient.

Taking away the cauſes of pain.] When a bone is disjointed, very violent pain enſues, and is followed by a fever, which is not to be cured but by replacing the bone, and ſo taking away the cauſe from whence the pain proceeded. The cure of pain will be treated of afterwards in a chapter ſet apart for this purpoſe.

## Of the DISEASES ariſing from a defect of the CIRCULATION, and of a PLETHORA.

### SECT. CVI.

THE diſeaſes ariſing from a defect of the circulation are very near the ſame with thoſe that ariſe in the humours from ſpontaneous reſt. Only it is to be remembered, that the admiſſion of air haſtens their ſpontaneous corruption, its excluſion retards it; and ſo the knowledge and cure of theſe is to be drawn from them (58 to 80). And from all theſe taken together, the nature, cauſe, effects, ſigns, and remedies of a plethora are to be underſtood, if due attention be given to the following particulars.

The liquids contained within us are either crude, and ſuch as retain the nature of the food we take down, at leaſt in part; or by the action of the body they have already acquired thoſe properties which belong to human fluids. If then we conſider, what may happen to crude or aſſimilated liquids, in caſe the circulation be diminiſhed, it will plainly appear, that the ſame changes will follow in great meaſure as would happen to them if they ſtood ſtill and were left to themſelves. If the blood ſtands ſtill but for a few moments, it is ſeparated into ſerum and a red coagulated maſs; ſomething like this happens, when the circulation is much diminiſhed, and thence ariſe thoſe polypous concretions which are ſo often obſerved after chronical diſeaſes. Now the crude ſubſtances we take down, are all changed into our nature by means of the circulation; if therefore this be defective, they will the longer retain their own nature, and be more liable to be corrupted by a ſpontaneous change. But as this ſubject has been treated of in the foregoing chapter, there can be no occaſion to reſume it here.

One thing only is to be obſerved, that the free acceſs of the air is apt to promote all the ſpontaneous corruptions of the humours. For there is no fermentation without air, and putrefaction comes on far more ſlowly when the air is excluded. Water ſtagnating in a ſwelled belly ſhall lie in a manner uncorrupted for many months, but ſhall preſently putrefy if expoſed to the air.

In the laſt months of pregnancy, when the blood very nearly ſtagnates in the greatly diſtended veſſels of the womb, there is no corruption: but when the fœtus is excluded, and the air has free acceſs, the lochia emit a very fetid ſmell. After a violent contuſion the extravaſated blood, which ſtagnates under the unbroken ſkin, hardly ever putrefies; but is by degrees attenuated, and being reſorbed vaniſhes away: but if extravaſated blood be expoſed to the open air, it ſhall preſently putrefy. If the humours therefore ſtagnate or move ſlowly in the internal parts of the body, where the air has no free acceſs, it ſhall not ſo ſoon degenerate into a ſtate of putrefaction.

But as the quantity of the liquid to be moved retards the velocity of the circulation, therefore the conſideration of this ſubject is ſubjoined to this chapter and its cauſes, nature, ſigns, and remedies, explained in the ſix following numbers.

α. A plethora is a greater quantity of good blood than is capable of undergoing thoſe changes, which unavoidably happen in life, without cauſing diſeaſes.

Too great a quantity of good blood is called a plethora, and conſequently of itſelf is never a diſeaſe; for we here ſuppoſe the humours increaſed to be good, and that all things elſe are well-conditioned. For this reaſon Helmont thought a plethora was undeſervedly ranked in the claſs of diſeaſes, as he judged, there could not be too great an abundance of what was good. But when we ſay, that a man is plethorick, we mean not that he is ſick already, but that he is in ſuch a ſtate of plenitude, that if the quantity of humours in him be farther increaſed, or theſe humours be rarified by heat or any other cauſe, the functions are liable to be damaged. Thus a man that is plethorick may be in a ſtate of health, but in the mean time is in the greateſt danger of being otherwiſe. For by an increaſe of heat in the ambient air, the leaſt fault of the non-naturals, a more violent paſſion than ordinary, &c. his perfect health is liable to be changed into the moſt dangerous diſeaſe; and it is impoſſible to prevent ſuch accidents from happening to the moſt healthful man. For which reaſon

Hippocrates ſaid (*a*), *Bene habita athletarum valetudo, ſi ad ſummum proceſſerit, periculoſa: non poſſunt enim in eodem ſtatu permanere neque conſiſtere: quum autem non conſiſtant, nec in melius poſſint proficere, ſupereſt ut in deterius vergant. Ob hæc ergo bonum illum habitum haud cunctanter ſolvere confert, &c.* "That the moſt "perfect health is dangerous; for as it cannot abide "in the ſame ſtate, nor yet change for the better; "it muſt therefore incline to the worſe. And there-"fore it was moſt adviſeable to alter this ſtate with-"out delay, *&c.*"

By a plethora therefore is not meant every increaſe of the humours, but only an increaſe of the quantity of good blood. For which reaſon Galen ſays (*b*), *Ubi æquabiliter inter ſe humores ſunt adaucti, illud plenitudinem & plethoram nominant: ubi verò vel flava bile, vel nigra, vel pituita, vel ſeroſis humoribus repletum corpus fuerit, talem affectum cacochymiam, non plethoram vocant*; "When the humours are all equably "increaſed, it is a fulneſs or plethora: but when the "body abounds too much with yellow or black bile, "or pituita, or ſerous humours, ſuch a diſpoſition is "called a cacochymy, not a plethora."

This fulneſs, according to the diſtinctions of the Antients, relates either to the veſſels or the powers (ϖρὸς ἀγγεῖα or ϖρὸς τὴν δύναμιν) when the veſſels are ſo full as to be in danger of burſting, or when by means of their too great diſtenſion the functions were not duly diſcharged, this was ſimply called plenitude, or plethora, *ad vaſa*; but when the veſſels were not too full in themſelves, but yet contained more than the weakneſs of the vital powers could move, this they called plenitude, or plethora, *ad vires*. The former is always and properly a fulneſs, the latter is ſo relatively with reſpect to the powers only. Thus Galen ſays (*c*), *duas eſſe plenitudinis ſpecies, vel ad virium robur*

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(*a*) Aphor. 3. Sect. 1. Charter. Tom. X. pag. 300.

(*b*) Meth. Med. Lib. XII. cap. 6.

(*c*) De plenitud. cap. 3. Charter. Tom. VII. pag. 326.

*robur & facultates corporis illam ſuſtinentis ; vel ad ſuſcipientem capacitatem :* " There are two ſorts of plethoras, either with reſpect to the ſtrength and powers " of the body ſuſtaining it, or as to its capacity of " containing it :" and elſewhere, " (*d*) *Quanto enim gravior ſibi videtur homo, tantum & plenitudinem quod vires creviſſe conſtat : ad eundem modum, quantum auctus fuerit tenſionis ſenſus, tantum & alteram auctam plenitudinem eſſe novimus, quam à quibuſdam* κατὰ τὸ ἔγχυμα *vocari diximus :* " So much as a man ſeems to him- " ſelf to be heavier or oppreſſed, ſo much is his ful- " neſs in reſpect of his powers ; and ſo much as the " ſenſe of tenſion ſeems to be increaſed, ſo much is " the other fulneſs increaſed, which ſome call κατὰ τὸ " ἔγχυμα.

However, in the common ſenſe of the word, a plethora is a fulneſs as to the veſſels ; and in this ſenſe it is uſed in this chapter.

β. This is generated by all thoſe cauſes that produce a large quantity of good chyle and blood, and at the ſame time prevent their attenuation and conſumption, or their being carried off by perſpiration.

The ſolids are unavoidably worn by the actions of health, and the fluids conſtantly flying off ; which waſte ought to be ſupplied by the aliment. If what is thus reſtored be equal to the loſs, the equilibrium will be preſerved, and this is the ſureſt ſign of perfect health ; as Sanctorius has by his experiments proved even to demonſtration, that the body would then be in perfect health, if it daily returned after digeſtion to its accuſtomed weight. This reſtitution of what is loſt, is wrought by good chyle and blood that is formed from it. If therefore a greater quantity of good

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(*d*) De curandi ratione per venæ ſectionem, cap. 6. Charter, Tom. X. pag. 434.

good chyle and blood be generated than is required to ſupply the waſte, the ſuperfluous part will by degrees be accumulated. And this will be very much increaſed, if the force of thoſe actions be leſſened, by which the liquids ought to be attenuated, conſumed, and carried off. The chief cauſes of theſe two particulars are contained in the following number.

γ. To which contribute a great contractile power in the viſcera, whoſe office it is to form the chyle, as alſo in the heart and arteries; together with a more lax contexture of the veins and other veſſels; mild food that is eaſily converted into chyle; much ſleep; a ſedate mind; reſt of the muſcles; and a habit of letting blood, whether natural or artificial.

A great contractile power of the viſcera, *&c.*] If the viſcera, whoſe office it is to change the aliment into chyle, be firm and ſtrong, a large quantity of chyle is drawn from the food we take down. And if the heart and arteries be equally ſtrong, this large quantity of chyle is converted into good blood; and as the veins are always naturally of a laxer nature, they will eaſily give way to the diſtending liquid, and admit this ſuperfluous quantity, unleſs they are emptied by exerciſe and motion. For as it was demonſtrated §. 105. the leſs motion there is in the veſſels, the more the humours are aggregated in the veins; whereas the greater the motion is, the more the arteries are filled, and the veins emptied. When hard drinkers pour down ſuch vaſt quantities of liquor, they would be ſuffocated, if the veins were not capable of giving way and receiving the ſuperfluous part of it, and therefore it is that theſe people have their veins ſo much inflated. If then much chyle and blood be formed in the ſeveral viſcera ſet apart for this purpoſe, and the laxity of the veins at the ſame time be proportionably greater, the quantity of good blood muſt of neceſſity be accumulated.

Mild food.] Whatever is acrid increaſes the circulatory motion, as has been obſerved already §. 99. numb. 2. and by this means leſſens the quantity of liquids, as has been ſhewn §. 100. a mild ſoft diet therefore, ſuch as grain well ripened, broth from fleſh, the fleſh of young animals, very ſmooth herbs, which yield a large quantity of ſmooth chyle, all favour the production of a plethora.

Much ſleep.] How much this contributes to relax the fibres when too rigid, has been ſhewn §. 35. numb. 2. but the veſſels when relaxed will more eaſily give way to the diſtending liquid, and conſequently be filled with more. Beſides in ſleep the loſs that was carried off by the actions of the ſenſes and our voluntary motions is repaired, as when we are awake thoſe things are conſumed which were accumulated in ſleep: and thus a man, who is tired with the labours of the day riſes chearful after ſuch a ſleep, as is proportioned to his health. When therefore we ſleep too long, a larger quantity is accumulated and leſs carried off, and hence ariſes a plethora. And hence we ſo often ſee bodies, that have been waſted by violent diſeaſes ſo well reſtored by long ſleep. Bears live all the winter without food, aſleep.

A quiet mind.] How much tranquillity of mind conduces to preſerve health is viſible to all. But a plethora is the effect of the moſt perfect health. Violent paſſions and conſuming cares feed upon the body too, as well as the mind. Hence Ovid (*e*) :

*Attenuant vigiles corpus miſerabile curæ ;*
*Adducitque cutim macies, & in aëra ſuccus*
*Corporis omnis abit ; vox tantum, atque oſſa ſuperſunt.*

Where pining wander'd the rejected fair,
'Till harraſs'd out, and worn away with care,

The

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(*e*) Metamorph. Lib. III.

The ſounding ſkeleton of blood bereft,
Beſides her bones and voice had nothing left.

Galen in the cure of too much fatneſs among other remedies reckons cares of the mind (*f*), τῆς ψυχῆς φροντίδας.

Reſt of the muſcles.] Ever ſince the ſentence, which God pronounced againſt man for the puniſhment of ſin, that in the ſweat of his face he ſhould eat bread, bodily exerciſe has been found neceſſary for the preſervation of health. When people of plentiful fortunes give themſelves up to ſloth and idleneſs, in return they fall into grievous diſeaſes, and ſuffer the puniſhment due to their lazineſs. Hippocrates has obſerved (*g*), *Homo comedens ſanus eſſe non poteſt, niſi etiam laboribus exerceatur. Cibi enim & labores adverſas inter ſe poteſtates, mutuò tamen ad ſanitatem conferentes, habent. Labores namque ea, quæ adſunt, conſumere ſolent; cibi verò & potus vacuato replere*; "That he "that eats cannot be well unleſs he labours. For food "and labour by their oppoſite effects both contribute "to health. For labour is apt to conſume what is "in the body; and food to ſupply what is wanting." And in another place (*h*) he lays down an excellent rule of health, and glories in being the firſt that ever preſcribed it; *i. e.* to conſider, *utrum cibi labores, an verò cibos labores ſuperent, an moderatè inter ſe habeant; quodcunque enim ſuperetur, ex eo morbi contingunt, ex mutua verò inter ſe æqualitate ſanitas adeſt*; "whe-"ther the food exceeds the exerciſe, or this the food; "or whether they be duly proportioned; for either "exceeding will cauſe diſeaſes, and on their due equa-"lity health depends."

To the maintaining of the equilibrium between the food and exerciſe, it is requiſite that a like quantity be carried off with that which is taken down;

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(*f*) Meth. Med. Lib. XIV. cap. 15. Charter. Tom. X. pag. 335.

(*g*) De victus ratione ſanorum, Lib. I. cap. 2. Charter. Tom. VI. pag. 448.

(*h*) Id. Lib. III. cap. 3. Charter. Tom. VI. pag. 481.

down; for if the quantity of the food be the ſame, and the exerciſe leſs, a plethora will begin to ariſe. If horſes are kept without exerciſe and well fed, they will ſoon grow fat; but if they be inured to violent exerciſe for a few days, all this increaſe will ſoon be carried off again.

An habit of loſing blood, whether naturally or artificially.] It is certain from obſervation, that the oftener a man loſes blood, provided he be not quite debilitated thereby, the ſooner does he fill with blood again. Women evacuate their ſuperfluous blood by a natural conſtitution every month; and in juſt the ſame term they fill again with freſh blood. Men uſed to frequent bleedings ſuffer the ſame inconveniencies at their accuſtomed times of bleeding, as women do by the retention of their menſes, 'till at length they loſe the proper ſtrength of men, and become lax like women. Dodart (*i*) has obſerved, that ſixteen ounces of blood taken away by venæſection, were repaired within five days in a man not weakened before. Thus does repeated bleeding diſpoſe to a plethora, by the blood's being ſo ſoon renewed; and perhaps too by the body's being rendered leſs ſtrong and more lax, and ſo more eaſily filled. I have ſeen a woman, that upon account of ſome violent affections of the mind, which frequently returned upon her, had been let blood ſixty times and more, in the ſpace of a year, during which time ſhe grew very fat, and gained 150 pounds in weight within the ſpace of a few months; and as the blood's increaſing ſo faſt brought on a neceſſity of bleeding again continually, at length, her body loſing all its firmneſs, ſhe fell into a dropſy. It is not therefore a commendable cuſtom, which ſome people have fallen into by way of precaution, to bleed often in a year, though they are well; ſince it weakens the body and diſpoſes it to fill more eaſily. Galen, though he frequently adviſes

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(*i*) Hiſt. de l'Academ. des Sciences, l'an. 1707. pag. 134.

adviſes bleeding, and that in the boldeſt manner even to fainting, and calls thoſe who diſlike ſuch bleedings ἀιμοφόϐȣς (*k*), men that were afraid to ſee their blood, yet he condemned this cuſtom, ſaying (*l*); *Nam per annum venam ſæpius ſecare, haud expedire arbitror; quod una cum ſanguine vitalis excernatur ſpiritus. Atque ſi hic copioſius abſumatur, tota moles refrigeratur, & omnes naturales operationes deterius perficiuntur*; "I reckon it not adviſeable to bleed often in a year; because the vital ſpirit paſſes out with the blood; which if it is much waſted, the whole maſs is rendered cold, and all the natural operations worſe performed."

δ. All the effects of a plethora depend on rarefaction, and that is to be aſcribed to the greater velocity and the heat occaſioned thereby, or to other cauſes which are to be known only by obſervation: hence follow the dilatation of the arteries, as well ſanguiferous as lymphatic; a change of the ſecretions; the compreſſion of the ſanguiferous and lymphatic veins; a ſtoppage of the circulation; inflammation; rupture of the veſſels; ſuppuration; gangrene; death.

All the effects of a plethora depend on rarefaction.] When the veſſels are too full of good blood, health may continue for a time; but if by any cauſe it be rarefied, then the functions begin to be diſordered. The changes which then appear are called the effects of the plethora, though they do not depend upon a ſingle cauſe, and the plethora be only the pre-diſpoſing cauſe, whilſt the rarefaction is the exciting or occaſional cauſe. For from theſe two cauſes united, to

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(*k*) Meth. Med. Lib. IX. cap. 5. Charter. Tom. X. pag. 210.

(*l*) De hirudin. revulſ. the laſt chapter near the end. Charter. Tom. X. pag. 455.

to wit, the pre-diſpoſing and exciting, ariſes the more immediate cauſe of the appearing ſymptoms; and as the exciting cauſe or rarefaction brings the plethora into action, which of itſelf, unleſs it were in a very great degree indeed, would not ſoon bring on any diſorder, ſo on this account the effects of a plethora are in this ſenſe ſaid to depend on rarefaction.

And that is to be aſcribed to greater velocity.] By an increaſed velocity we mean a greater quantity of blood flowing through the veſſels in the ſame time: but this can never be without an increaſe of the attrition of the liquids and veſſels, whence comes heat, and from heat rarefaction. All the cauſes that are known by obſervation to rarefy the blood, ſeem to do it more eſpecially by increaſing its celerity, and by the heat which proceeds from thence. Rarefaction alone is farther capable of producing a plethora. For if the blood be rendered twice as rare as it was, it is the ſame thing with reſpect to the veſſels, as if there were really twice the quantity of blood contained in them. Rarefaction therefore coming upon a plethora, increaſes all the inconveniencies which can poſſibly ariſe from a plethora. Hence it appears, why all the medicines and diſeaſes, that occaſion heat by increaſing the celerity of the blood and rarefying it, bring on alſo all the ſymptoms of a plethora. A pale young woman of a cold conſtitution is infected with the ſmall-pox; preſently there comes on a heat and redneſs, an inflammatory tenſion of the veſſels, an exceſſive pain in the head, *&c.* not from any increaſe of the quantity of the blood, but from its rarefaction by the greater heat, which has ariſen from its accelerated motion.

Hence follow a dilatation of the arteries.] When the blood is increaſed in quantity, or by being rarefied takes up a greater ſpace, it will neceſſarily dilate the veſſels wherein it is contained, and thus both arteries and veins will be alike diſtended. But the blood cannot ſo eaſily be propelled from the arteries into the veins, when they are too much diſtended, and conſequently there will be a greater reſiſtance at the extremities of the arteries. The arteries therefore muſt of courſe be the more diſtended by the blood that is thrown into them from the heart. Farther, as the different proportion, which the ſecreting branches bear to the trunk from whence they riſe, is reckoned by phyſiologiſts amongſt the cauſes aſſigned for the ſecretion of ſo many various humours in different places from one and the ſame blood; it is plain, that as this proportion muſt be varied by the dilatation of the arteries, ſo may all the ſecretions by this means be made irregular too.

The compreſſion of the veins, *&c.*] In moſt parts of the body there are veins which accompany the arteries; and having weaker coats they muſt be compreſſed by the arteries when they ſwell too much, as they lie ſo near them; but the veins when compreſſed propel the fluids they contain towards the heart; the heart drives it forward into the arteries, and the veins being compreſſed are leſs able to receive it: hence there neceſſarily follows a ſtill greater dilatation of the arteries, 'till at length the blood is almoſt entirely accumulated in the arteries, whilſt the veins are ſtill more compreſſed and emptied.

The circulation ſtopped.] For thus the reſiſtance that is made to the blood, which is driven from the left ventricle of the heart, is increaſed every moment; and conſequently the pulmonary veins will not be able ſo eaſily to empty themſelves into the left ventricle of the heart; the blood therefore will begin to be accumulated in the veſſels of the lungs, the reſiſtance to the right ventricle of the heart will be increaſed, and at laſt the circulation ſtopped. Thus we ſee men that are plethorick to the higheſt degree are very red, the ſmaller arteries being dilated and admitting the red blood, 'till at length they begin to grow livid, being almoſt ſuffocated; and unleſs the quantity be leſſened by a diſcharge from the veſſels, either naturally or artificially, and by this means the heat and rarefaction be diminiſhed, they ſhall often die ſuddenly.

Inflammation.] Through the thicker humours entring the leaſt veſſels when thus dilated, and not being able to paſs through their narrow extremities.

Rupture of the veſſels.] Eſpecially in thoſe parts of the body where the veſſels are tender; for this reaſon plethoric perſons are ſo frequently carried off by apoplexies, an artery being burſt in the brain; and for the ſame cauſe we ſee them ſo often ſubject to an hæmoptoe, the pulmonary veſſels being broken by the diſtending blood.

Suppuration, gangrene.] Theſe are the common effects of an inflammation not reſolved.

Death.] Which ſeems to be, becauſe the veſſels are ſo extremely diſtended as to reſiſt the evacuation of the heart, whereby the circulation is ſtopt; or becauſe the greater veſſels being too full, compreſs the ſmaller in the cerebrum, cerebellum, and nerves; or becauſe the veſſels break and effuſe the humours neceſſary to life; or, laſtly becauſe the extravaſated humours, which have iſſued from the broken veſſels, deſtroy the actions of the viſcera, whereon life dedepends.

ε. It is therefore eaſily to be known when preſent; and its future effects as eaſily foreſeen.

We know that there is a plethora, if the cauſes mentioned (β) and (γ), as apt to generate too large a quantity of good blood, have preceded; if there be a great redneſs over the whole body, and more eſpecially in ſuch parts where the veſſels lie expoſed and uncovered with the ſkin, as the corners of the eyes, the inſide of the eye-lids, the *tunica adnata* of the eyes, the inſide of the noſe, mouth, fauces, lips: if there be great heat even in the extremities; if the veins are inflated, and at the ſame time the pulſe be ſtrong and full; if upon an increaſe of motion or heat in the weather, or upon drinking wine, or taking anything that is heating, there is felt a ſoft full diſtending tumour in all the muſcles of the body, with a kind of immobility, ſo that the hands can ſcarce be cloſed, and this be followed by dulneſs and drowſineſs, and a diſtillation of a watery humour from the eyes. Theſe are the ſymptoms which ſupply us with a perfect diagnoſtic of a plethora.

The prognoſis contains all the future diſorders mentioned already in the paragraph (δ); more eſpecially that all the functions of the head will be irregularly diſcharged, becauſe in the head all is full naturally; and thus if the great veſſels, which are filled with red blood, are diſtended, the leſs will neceſſarily be compreſſed, for the hard bone of the cranium will not give way: and thus may all the diſeaſes of the brain, from a ſlight vertigo, to a mortal apoplexy, take their riſe from a plethora.

ζ. The cure is wrought by bleeding, exerciſe, watchings, a more acrid diet after evacuations, and dropping evacuations by degrees.

Bleeding.] Too much blood, we have obſerved, was the cauſe of the diſeaſe; whatever therefore leſſens the quantity of it will be found to be of ſervice; but the ſpeedieſt way of leſſening the quantity is by opening a vein, and therefore bleeding immediately relieves all the ſymptoms. Medicine never cures diſeaſes better than when it imitates nature. Now we ſee both in health and diſeaſes a plethora, whether ariſing from too great a quantity of the blood, or from too great a rarefaction, is happily removed by a ſalutary hæmorrhage, particularly at the noſe. For this reaſon this evacuation is ſo often ſerviceable to young people, that are ſtrong and healthy, at that time of life, when the veſſels being grown firm give a greater reſiſtance to the diſtending liquids, and eſpecially as the warm weather comes on in the ſpring. And upon the ſame account, in very violent fevers, relief has been ſo frequently obtained by a ſpontaneous bleeding at the noſe. In proceſs of time, art, in imitation of thoſe ſalutary efforts of nature, directed the opening of a vein; if it appears by the proper ſigns that the arteries only were principally diſtended, and the veins in a collapſed ſtate, from the ſtoppage of the blood in the arteries, by reaſon of its being too thick to paſs through them into the veins, as is often the caſe in acute inflammatory diſeaſes, they then ventured to open even the arteries; and becauſe this could not be done frequently in the greater arteries without ſome danger, by cutting through many of the ſmaller kind, by ſcarification they in great meaſure anſwered the ſame end. For this cauſe ſcarifications have been ſo much uſed in Egypt where acute diſeaſes have been very common, as you may find from Proſper Alpinus in his *Medicina Ægyptiorum*.

Some perſons, and the followers of Helmont in particular, have condemned bleeding as a cruel and uſeleſs practice, upon a ſuppoſition, that the too great quantity of blood might more effectually be diminiſhed by a total abſtinence from all food, for as the quantity of humours daily carried off by inſenſible perſpiration, and the other ſenſible excretions, amounts in weight to ſeveral pounds, and this weight is again reſtored by the ſubſtance which we eat and drink; it is plain, if the liquids were continually to be diminiſhed by theſe natural evacuations, and no freſh ſupplies were furniſhed by food, the quantity of liquids would be more leſſened by abſtinence in four and twenty hours, then it could poſſibly be by the boldeſt bleeding; but the inconvenience of this method is, that by this means the thinner liquids are only carried off, whilſt the red blood, that diſtends the larger veſſels, is ſcarce diminiſhed at all, though this be the circumſtance that is principally wanting, and all the humours are rendered ſharper for want of freſh chyle to mix with the blood.

But though bleeding leſſens the quantity, yet as it leaves the body more liable to fill again, and conſequently more diſpoſed to produce a freſh plethora, as has been obſerved already in the paragraph (γ), it is requiſite ſo to ſtrengthen it, that it may not be liable to accumulate good blood ſo eaſily: and this is to be done chiefly

By labour.] Which both carries off that which would be retained in a ſtate of idleneſs, and gives ſuch a firmneſs to the ſolids, that they do not eaſily yield to the filling liquids. You ſeldom ſee working people plethorick, who labour hard every day, though they eat moſt voraciouſly. However, we muſt not preſcribe exerciſe 'till the veſſels are firſt emptied by bleeding, for otherwiſe veſſels ſo much diſtended would be apt to break.

Watchings.] Too much ſleep was reckoned among the cauſes of a plethora (γ); watchings therefore will have an oppoſite effect.

By a more acrid diet after evacuations.] Soft meats that are eaſily digeſted by the viſcera, whoſe office it is to prepare the chyle, ſupply a large quantity of chyle, by which means the quantity of blood is daily increaſed, unleſs the ſuperfluous part be carried off by the more effectual motion of the humours. Thus nature provides the ſofteſt milk for infants, which is food already digeſted in the body of the mother, becauſe the ſwift growth of that age requires a daily increaſe of humours; but in the contrary caſe, as in the cure of a plethora, the harder meats, ſuch as are difficult to digeſt, and the ſharper ſtimulating aromatic ſauces, are more ſerviceable; as theſe make leſs chyle, and conſequently, *cæteris paribus*, leſs blood; and farther, as acrid ſubſtances by their ſtimulating quality occaſion an increaſe of motion, and prevent the accumulation of humours. But before the quantity is leſſened by evacuations, acrid food would endanger a rupa rupture of the veſſels, by increaſing the motion in them, when they are already too full.

Omitting evacuations by degrees.] How much frequent bleeding contributes to a plethora, has been obſerved already at the letter (γ) in this ſection. This evacuation therefore is to be left off; and yet not at once, becauſe all ſudden changes from one habit to the contrary extreme are abſolutely wrong, and eſpecially in this caſe. For by frequent bleeding the body acquires a habit of accumulating a greater quantity, which if not conquered will bring on all the effects of a plethora; the quantity therefore of theſe evacuations is to be leſſened by degrees, and the diſtance of time between them increaſed; that thus they may be gradually left off without danger. And in ſo doing we imitate that ſalutary method which nature makes uſe of in women, at the time their menſes begin to leave them: for they naturally decreaſe in quantity, by gentle degrees, and have longer intervals before they return, 'till at length they quite ceaſe: whereas when they ſtop all at once, very bad conſequences are apt to follow.

The

# The moſt ſimple of the compound DISEASES, an OBSTRUCTRON and a WOUND.

## An OBSTRUCTION.

### SECT. CVII.

AN obſtruction is a ſtoppage in a canal, denying a paſſage to the liquid, whether vital, ſound, or morbid, that ought to paſs through it, and ariſing from the bulk of the matter that is to paſs being greater than the capacity of the veſſel that is to tranſmit it.

Of all the compound diſeaſes indeed, the moſt ſimple would be a wound, as it ſuppoſes only the coheſion of the ſolid parts to be ſeparated : but as there can be no wound of any conſequence without an effuſion of the liquids contained in the veſſels, which then follow their own nature, it becomes neceſſary to conſider the ſpontaneous degenerations of the liquids firſt. Beſides, when the canals are cut through, they at firſt let out the liquids that were in them ; and then cloſing more up, they let go a thinner liquid only ; and at length, being quite ſtopped, an obſtruction follows, and the flux ceaſes, as will appear hereafter when we come to treat of a wound in general. And for this reaſon, according to the rule laid down §. 160. an obſtruction is to be conſidered firſt, as it takes place in every wound.

An obſtruction is the ſtopping up of a canal.] This is the moſt general idea of an obſtruction, as ſuppoſing any hindrance whatever to the paſſage of the liquids through the canals. By a canal is here meant principally every veſſel through which a liquid is continually paſſing, as in the arteries and veins: for thoſe canals, through which a liquid paſſes not conſtantly, but only at ſome certain times, are rather to be called emiſſaries; though an obſtruction may ariſe in theſe too, as often happens in the bilious ducts, the urethra, *&c.*

All the liquids of the body are either carried by a continual motion through the veſſels, or being collected in larger receivers, reſide there only for a certain time. An obſtruction ſeems chiefly to take place in the veſſels, and very ſeldom or ever in the larger receivers; for a ſtone in the bladder, unleſs it be big enough to fill up the whole cavity, makes no obſtruction 'till it comes into the urethra. Polypous concretions, though formed in the venal ſinuſes, or even in the cavities of the heart, make no obſtruction, 'till they paſs out of theſe receptacles into the canals.

Vital, ſound.] After the general definition of an obſtruction, it is next to be conſidered, how many kinds of liquids are hindered from paſſing through the obſtructed canals. This may be even the vital liquid, which paſſing to the heart is thrown from thence through the lungs and the aorta, and again returns to the heart for the ſupport of life; but life may ſubſiſt for a conſiderable time, though perfect health be wanting, as this conſiſts in the perfect integrity of all the functions, which requires alſo a free paſſage through all the canals: ſo that there may be a great many obſtructions, which ſhall be detrimental to health, and yet life remain notwithſtanding. Thus if a ſmall calculous concretion, which is the firſt rudiment of a ſtone, be formed in one of the ſmall urinary tubes of the kidneys, an obſtruction will thence ariſe, which will hinder the paſſage of the ſound liquid, that ought to paſs through this tube, and yet no extraordinary impediment to the motion of the vital liquids will follow from this circumſtance, though the action of that canal, which is requiſite to perfect health, be by this means taken away.

Or morbid.] Morbid liquids are all ſuch as are ſo far degenerated from the natural ſtate of ſound liquids, as to diſorder the functions, nor does it matter whether this degeneration may have been the cauſe or the effect of this diſeaſe. Thus in a pleuriſy an inflammatory ſpiſſitude of the blood, which is the pre-diſpoſing cauſe of a future pleuriſy, makes the blood morbid, or apt to diſorder the functions. But in the ſmall-pox, where all the blood is corrupted with a purulent taint, the morbid ſtate of the humours is the effect of the diſeaſe, and did not exiſt before it was brought on by the diſeaſe. Now theſe morbid liquids are ſometimes carried alone through the canals, and ſometimes mixed with other liquids, which have not as yet declined from a ſtate of ſanity; an obſtruction therefore may be formed in the canals, which ſhall alſo interrupt the paſſage of theſe morbid liquids; and this is very evident in ſeveral diſeaſes, where the morbid humours are by the vital powers tranſlated from one place to another, as in the tumours of the parotid glands and the purulent abſceſſes of the legs, which are ſo ſalutary in a pleuriſy and peripneumony. And thus in a true gout, if nature be hindered from throwing out that part of the moſt ſubtle liquid, which is degenerated, upon the joints of the feet, what terrible miſchiefs will enſue!

Ariſing from the bulk of the matter that is to paſs, *&c.*] This gives us a juſt idea of the proximate cauſe of all obſtructions. The compreſſion of the veſſels will be hereafter mentioned among the cauſes of obſtruction; and yet if the liquid were ſtill thin enough to paſs through the veſſel ſo compreſſed, there would not in this caſe be any obſtruction formed; for an obſtruction does not only imply a difficult paſſage, but the entire ſtopping up of the canal.

## SECT. CVIII.

WHICH ariſes from the narrowneſs of the veſſel, from the bulk of the matter that is to paſs through it, or from both theſe together.

Theſe three particulars contain all the poſſible cauſes of an obſtruction: for either the liquid that is to paſs is grown thicker, while the capacity of the canal remains the ſame; or the canal is grown narrower, whilſt the liquid remains as it was; or the narrowneſs of the canal and the thickneſs of the liquid are joined together. The cauſes of each of theſe particulars, or of both of them together, are now to be enquired into.

## SECT. CIX.

THE ſtraitneſs of a veſſel may ariſe either from an external compreſſion, or its own proper contraction, or an increaſe of thickneſs in the membranes themſelves that form it.

We have here aſſigned the ſeveral cauſes by which the canals may become more narrow, the liquid to be tranſmitted continuing in the ſame degree of tenuity as before.

By external compreſſion.] This is called by the Greeks ϑλίψις. In our canals a ſection perpendicular to their axis is always a circle; which as it contains the largeſt area that can be contained within the ſame circumference, all external compreſſion by changing the circular figure muſt of courſe diminiſh the capacity of the canal; or could the compreſſing force be conceived to act equally all around the circuit of the veſſel; though in this caſe it would not alter the circular figure, it would leſſen the diameter, and ſo render the cavity in like manner narrower.

By its own proper contraction.] In this caſe the veſſel is ſaid to be contracted by its own ſpring. For the ſides of the veſſels naturally approach nearer to their axis, as ſoon as ever the diſtending cauſe is leſſened. This was neceſſary, that when the quantity of humours is diminiſhed, the circulation might continue uninterrupted through the veſſels, continuing ſtill full indeed, but by contraction grown narrower. And this is the reaſon, that a great and ſudden loſs of blood, before the veſſels have time to contract and ſo keep themſelves full, by interrupting the circulation, ſhall cauſe a ſyncope, and ſometimes death, in caſe the inanition be very ſudden indeed. If therefore this contraction, which belongs to our veſſels, be increaſed, or the force or quantity of liquids diſtending them be leſſened, the ſame effect will follow, and the canals be rendered narrower.

Or by an increaſe of thickneſs in the membranes.] It is plain, that if the thickneſs of the membranes be increaſed, the cavity of the canals muſt be made narrower. To diſtinguiſh this cauſe of obſtruction from the θλίψις, the Antients have termed it στενοχωρία, or ſtraitening of the paſſage, to denote that the cavity was made narrower by an increaſe of ſubſtance in the ſides of the canal.

## SECT. CX.

THE bulk of the matter to be tranſmitted is increaſed by the viſcoſity of the fluid, or by its being admitted into a wrong veſſel.

In this paragraph are conſidered the faults in the fluid, which may cauſe an obſtruction, though the capacity of the canal remains the ſame.

The elementary particles, whereof our humours are compoſed, have a determinate magnitude proportional to the narroweſt extremity of the veſſels through which they are to paſs. Thus an elementary particle of red blood ought to be ſo ſmall, as to paſs through the narroweſt extremity of the ſmalleſt red artery; and ſo in the other orders of the thinner liquids. If then by any cauſe whatever the elementary particles, whereof the liquids are compoſed, be increaſed in bulk, they will ſtop at the extremities of the arteries; becauſe, as Leuwenhoeck's obſervations ſhew, the particles of red blood paſs ſingle through the extremities of the arteries, and that with ſome difficulty; ſhould they then be expanded, ſo as to take up a greater ſpace, whilſt the quantity of the matter they contain remains the ſame, the freedom of their courſe would be interrupted; ſo that we may conceive this to be the cauſe of an obſtruction, though perhaps it very rarely happens.

But there may be another fault in the liquids which perhaps is much more common. The particles of all fluids, as the natural philoſophers have proved, cohere with a certain degree of force; which alſo obtains in our humours: but that the particles of theſe may paſs through the extremities of our veſſels, it is requiſite, that they paſs ſingle and ſeparated from their coheſion with the reſt; the powers therefore that carry the humours through the veſſels muſt be able to overcome this coheſion. Should therefore the coheſion of the elementaty particles be ſo increaſed, as not to ſuffer themſelves to be divided from each other by the action of the heart and veſſels; ſeveral of them will remain united together in parcels, which ought to paſs ſingly through the extremities of the veſſels; by which means there will be formed an obſtruction; this is called an increaſe of their viſcoſity, as we have not a more general term to expreſs it by, though it denotes only that phyſical ſtate, which renders a fluid leſs capable of paſſing through a canal, by reaſon of the too great coheſion of the elementary particles whereof it conſiſts.

By its being admitted into a wrong veſſel.] This is ſaid to be the caſe, when good humours have entered into veſſels where they naturally ought not to be, and through whoſe extremities they cannot paſs. V. g. When red blood enters the ſerous or lymphatick arteries, by their being too much dilated in their firſt openings, this blood is ſaid to be admitted into a wrong place: thus though the humours have all their proper qualities, and the veſſels be all ſound, yet if by being only dilated a little too much in their cavities, they admit of a groſſer liquid, the moſt obſtinate obſtructions may be formed. And this indeed is the moſt frequent cauſe from whence obſtructions in general do ariſe; for if the impetus of the circulating fluid be at all increaſed, the red blood ſhall preſently enter into ſuch veſſels as do not belong to it. Thus if the eyes be rubbed ever ſo gently, there ariſes a redneſs in the *tunica adnata*, where naturally there is no red blood at all. Upon violent running the ſkin ſhall grow extremely red, from the red blood's being driven into the ſmaller veſſels. For though, properly ſpeaking, the bulk of the particles that conſtitute the fluids is not increaſed, yet with regard to the veſſels, whereinto they are wrongfully admitted, it is their too great bulk which is the cauſe of the obſtruction.

## SECT. CXI.

AND from both by a concurrence of the cauſes of both (109, 110).

For it is poſſible that the cauſes which ſtraiten the canal, and thoſe that render the liquid unpaſſable, may concur together.

Hence it appears to what ſimplicity this whole matter might be reduced, if the proximate cauſe only of all obſtruction was to be conſidered. But the difficulty lies in this, that their remote cauſes are ſo many and ſo various, which we are now going to enumerate.

## S E C T. CXII.

THE veſſels are compreſſed externally,

1. By a neighbouring tumour, either plethorick, inflammatory, purulent, ſchirrhous, cancerous, œdematous, ampullary, ſteatomatous, atheromatous, meliceratous, hydatidick, aneuriſmatick, varicous, pituitous, calculous, or callous.

1. A tumour.] Phyſicians and Chirurgeons have given the name of tumour to the increaſe either of a particular part, or of the whole body, when it riſes above its natural magnitude, from what cauſe ſoever it may proceed. As therefore the part, which ſwells, takes up a greater ſpace than it did before, it muſt neceſſarily make the veſſels near it narrower by compreſſing them. Now theſe tumours muſt all ariſe, either from the fluids diſtending the veſſels beyond their natural bulk, or from their being extravaſated, or from the veſſels being concreted with their inſpiſſated liquids. Of theſe tumours the principal differences are ſuch as have been here enumerated.

Plethorick.] Namely, when the arteries and veins, which are charged with red blood, are ſo diſtended by the quantity they contain as to compreſs the ſmaller veſſels that lie near them. The effects of this kind of tumour are eſpecially ſeen in the damage it does to the actions of the brain: for the cranium being always entirely full, and no red blood being any where to be found but in the *pia mater*, and the large red arteries diſperſed through the medullary ſubſtance of the brain, and ſurrounding the *medulla oblongata*, the cortical ſubſtance naturally containing none, it follows, that when theſe red blood-veſſels are diſtended, as the hard boney part of the cranium cannot give way, the other veſſels of the cortical ſubſtance and the medulla muſt be compreſſed, by which means all the functions of the brain will be diſordered; only the cerebellum, being much firmer than the cerebrum, will in this caſe be the leſs affected.

Inflammatory.] When the vital power drives the vital liquid into an inflamed veſſel, it muſt neceſſarily diſtend that veſſel, becauſe the liquid thus impelled cannot paſs through an obſtructed veſſel; for which reaſon the whole impetus of the impelled liquid is employed in dilating the ſides of the veſſel, which lie immndiately before the obſtructed place, and of courſe the adjacent veſſels will be compreſſed; ſo that the circulation will hereby be interrupted, not only in the inflamed veſſels, but in the veſſels alſo that lie near them: hence the tumour increaſes, and eſpecially if the cellulous membrane be inflamed; in which caſe a tumour ſhall grow ſo big, that an inflamed finger ſhall at ſome times be ten times thicker than in a natural ſtate.

Purulent.] Which is of two ſorts, either from pus incloſed in its proper membranes, and forming a purulent impoſthume; or when theſe are burſt, and the pus is diſcharged into the vacuities that lie near it, both ways it muſt ſtraiten the neighbouring veſſels by its preſſure; hence whenever there is a gathering in the ſubcutaneous parts, we generally find the veſſels of the ſkin inflamed.

Schirrhous, cancerous.] This ariſes from a gland firſt ſwelled and then indurated; by which means the veſſels diſperſed through the proper membranes of the gland, as alſo in the parts that lie near it, are compreſſed, and therefore a large ſchirrhus is always attended with varicous veins. What dreadful miſchiefs have ariſen from a ſchirrhous tumour in the parotid glands, which by preſſing upon the adjacent jugular veins has prevented the return of the blood from the head? If the axillary and inguinal glands become ſchirrhous, by compreſſing the neighbouring veins, arteries and nerves, they will deprive the parts that lie under them of all vital humours, as may be ſeen from abundance of inſtances recorded by the writers of obſervations. But when the ſchirrhus by an increaſe of malignity degenerates into a cancer, as the tumour is then conſtantly increaſed, it proves always the more prejudicial.

Œdematous.] Galen obſerves that the Antients called every ſwelling by the name of Οἴδημα, *Antiqui & tumorem oidema appellabant* (*a*); and elſewhere, that preternatural humours were termed οἰδήματα by Hippocrates (*b*); but afterwards the later writers, he ſays, laid aſide this uſe of the word, and called each tumour by a diſtinct name: if they were painful, they were called *phlegmones*; if without pain, or hard, *ſchirri*; if without pain and ſoft, they were then properly called οἰδήματα. But Hippocrates calls ſuch ſoft indolent tumours not ſimply οἰδήματα, but adds another word to diſtinguiſh them from other tumours. Thus in the Prognoſticks and Coan Prenotions, they are called οἰδήματα μαλθακὰ, ἀνώδυνα, τῷ δακτύλῳ ὑπείκοντα, ſoft indolent tumours, that yield to the preſſure of the finger. This is the meaning of the word at preſent, which is applied only to tumours, that ariſe in the *membrana celluloſa*, the true ſeat of an œdematous ſwelling. The matter of them is generally water, as in the anaſarcous dropſy; or ſome more viſcid pituitous liquid, as in a leucophlegmatia. Now a *membrana celluloſa*, which is the true ſeat of theſe tumours, ſurrounds all the veſſels; and conſequently the tumours ariſing thence are capable of making all the veſſels narrower, and frequently of producing very ſurprizing diſeaſes, which ſhall be entirely owing to this ſingle cauſe.

Ampullary.] Such ampullæ or follicles are very numerous in ſeveral parts of the body; the whole ſkin, the inſide of the mouth, throat, ſtomach, and inteſtines

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(*a*) Comment. IV. Aphor. 34. Charter. Tom. IX. pag. 115.

(*b*) Comment. V. Aphor. 65. Charter. Tom. IX. pag. 239.

inteſtines are thick ſet with them. Iin theſe a fat or mucilaginous humour, ſecreted from the arterial blood flows through its proper emiſſary, and ſerves to lubricate and anoint theſe parts. If then this emiſſary ſhould chance to be obſtructed, the quantity of it will be increaſed, and the follicle diſtended; and this to ſuch a degree, that from a ſize too ſmall to be diſcerned by tfie naked eye, it ſhall grow up to the weight of ſeveral pounds; thoſe minute little receptacles in the hairy part of the head that ſupply the unctuous liniment, which feeds and lubricates the hair, grow ſometimes to an immenſe bulk, and are called *moles* by the Chirurgeons. Many inſtances of the like tumours in other parts of the body are alſo to be found among the writers of obſervations.

This is the general idea of theſe ampullary tumours: but they differ very much, according to the nature of the matter they contain, and have thence received a very different name. If the matter reſemble a mixture of flour and water, it is called an *atheroma:* if it is of a middle degree of fluidity between honey and wax, it is named a *meliceris:* if it is of a ſomewhat harder conſiſtence, and looks like fat, it is termed *ſteatomatous.* But of theſe ſee §. 75. before.

Hydatidick.] Hydatides, as the word is now uſed, (for heretofore it ſignified an increaſe of the fat which lies under the outer part of the upper eye-lid(*c*), are little membranaceous bags of various ſize, which are often found in divers parts of the body, both external and internal, filled with a watery humour. But whether theſe are to be always conſidered as ampullary tumours, ſeems at preſent very doubtful; for theſe tumours, as we have already obſerved, are no other than the natural follicles dilated and ſwelled; but hydatides have been found in places where no follicles have ever been diſcovered by any anatomiſts; thus Ruyſch found the uterine placenta entirely changed into

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(*c*) Gorræi definit. Medic. pag. 656.

into hydatides *(d.)* Nay ſuch hydatides have been even found fluctuating and unconnected either with any of the neighbouring parts, or with each other, and included in a large membranaceous bag: and which is ſtill ſtranger, the large hydatides have contained leſſer ones alike looſe in their cavity *(e)*: and farther, when the waters taken out of dropſical perſons that have died have been boiled, it has been found that the very ſubſtance of the follicles, which had appeared to be membranaceous, was diſſolved *(f)*. For which reaſon ſome great men have concluded, that the pellicles of theſe hydatides were not organical parts, but accidentally produced by the incraſſation of the liquids. However there is nothing to hinder, but that the natural follicles may be expanded by a watery humour to an enormous ſize: ſuch hydatides are often obſerved in the edges of the eye-lids, the ſebaceous glands, which are ſeated here, poſſibly degenerating into this form. Ruyſch found one of the ova in the ovarium of a woman thus expanded into a very large bulk, and full of liquid *(g)*.

That ſuch hydatidick tumours havs been found in various parts of the body, appears plainly from the paſſages in the authors we have already cited, to which might be added abundance of other inſtances from Bonetus and other writers of obſervations.

Aneuriſmatick.] An aneuriſm, or rather aneuryſm, ἀπὸ τȣ̃ ἀνευρύνειν, denotes the preternatural dilatation of an arterery in any part, ſo that from an uniform conical figure which it had before, it ſhall be changed in the part that is weakened into a ſinus, which by compreſſing the neighbouring parts ſhall be capable of producing terrible miſchief. Thus the ſagacious Albertinus *(h)* to his great ſurprize found the ribs, clavicles, and ſternum, not only elevated, but broken, and

(*d*) Obſervat. Chirurg. p. 33. (*e*) Acta Petropolitan. Tom I. pag. 379—382. Acad. de ſciences, l'an. 1722. Mem. p. 222.

(*f*) Acad. des ſciences, l'an. 1719. Hiſt. pag 49. (*g*) Obſervat. Chirurg. 17. (*h*) Inſtitut. Bononienſ. pag. 383.

and the inſide of the vertebræ of the back worn away quite down to the ſpinal marrow, and conſumed by an aneuryſm near the vital parts. Ruyſch found the ribs quite carious, and even waſted, together with the ſternum, by nothing but an aneuryſm *(i)*.

Varicous.] What an aneuryſm is in the arteries, that a varix is in the veins, and a much more frequent diſorder, as the veins yield to the diſtending blood more eaſily, and the blood moves ſlower in them than in the arteries; for which reaſon a ſmall obſtacle ſhall ſuffice to hinder the motion of the blood in the veins, by which they ſhall be diſtended and become varicous. This incident more particularily happens to women with child; becauſe when the womb is diſtended and preſſes upon the iliack veins, it prevents the veins of the thighs and legs from diſcharging the blood they contain ſo expeditiouſly as they ought; for which reaſon they are ſubject to theſe varicous tumours, and eſpecially in the legs.

Tophous.] In this diſorder, the lamellæ, which conſtitute one of the larger bones, are by the diſeaſe removed from each other, elevated and formed into a tumour, not quite ſo hard as a bone indeed, but hard enough to be pared, and of a reſembling degree of firmneſs with that of the horns of young animals at their firſt budding. Such tumours frequently occur in all the diſeaſes, which are more particularly apt to affect the bones, as in the rickets, ſcurvy, and more eſpecially in a confirmed pox; in which diſeaſe theſe tumours, by compreſſing the veſſels of the perioſteum, and diſtending the nerves, which have here a moſt exquiſite ſenſe, become extremely painful. To this head belongs an exoſtoſis in which caſe the hard ſubſtance of the bone itſelf is elevated into a tumour, and compreſſes the veſſels that lie near it.

Pituitous.] This ariſes from an accumulation of the natural or morbid gluten, which diſtends the cavities wherein it lies, and thereby preſſes the veſſels that are adjacent to it.

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(i) Obſervat. Chirurg. 37, 38.

Calculous.] Every one knows the terrible conſequences ariſing from ſtones in the kidneys, ureters, and bladder, whilſt they compreſs the parts they lie on by their ſize and weight.

Callous.] A callus is a membranaceous part increaſed in bulk, attended with hardneſs and inſenſibility, ariſing from the veſſels being concreted together, and chiefly by an external compreſſion. Its proximate cauſe is the compreſſion of the veſſels, the expreſſion of the liquid they contain, and the concretion of their ſides. In infants juſt born there is no callus ſeen, but afterwards when they begin to walk, and the whole weight of the body is ſuſtained by the bottom of the feet, the veſſels becoming flat they loſe their liquids, and begin to grow together and form a callus. So the palms of the hands in ſmiths often grow as hard as horn by the attrition of the hammer. Now as a callus is deſtitute of all vital liquid, of itſelf it can do no greater miſchief, but as by its ſize and hardneſs it oppreſſed the parts that lie underneath it, it may cauſe an inflammation, and bring on other very troubleſome diſorders. Thus it has been found, that an hard callus near the prominence of the metatarſal bone, that ſuſtains the great toe, has almoſt entirely taken away the uſe of the foot; while the whole weight of the body preſſed this hard callus againſt the inflamed and much pained parts that were placed under it. When the nervous papillæ in the ſkin, with the ſanguineous and lymphatick veſſels, *&c.* with which their extremities are covered, are preſſed flat, a ſlight inflammation firſt follows, and afterward all turns as hard as horn, and then we call it *clavus* or corn; which is a very very common and no leſs troubleſome diſorder in the toes, and ſometimes in the external part of the ear, when its cartilaginous folds are too much preſſed by the coverings worn upon the head; or when a perſon is obliged to lie only on one ſide, from wounds, empyema, &c. and ſo continually preſſing the ear againſt the pillow. Theſe corns are true callus's, but very hard, and being broader outwardly, and by degrees converging inwardly as they deſcend under the ſkin, they derive their name of *clavi* from their figure; and as they adhere to the nervous parts which have a quick ſenſe, they therefore cauſe ſuch an exceſſive pain when preſſed upon. The ſame kind of callus's may ariſe alſo from a compreſſion in the inward parts. Upon opening the body of a young woman, I have ſeen the external coat of the ſpleen, which was much larger than uſual, and had been preſſed againſt the laſt of the ribs, both callous and thicker by far than it ought to have been, preciſely in that place where it had been expoſed to the preſſure.

2. From the hard parts being broken, disjointed, diſtorted, diſtracted, and thereby compreſſing the flexible veſſels.

We have here enumerated the ſeveral ways by which the veſſels are ſtraitened, from the external compreſſion that ariſes from the removal of the hard parts of the body, ſuch as the bones and cartilages, out of their natural poſition, and thereby preſſing the adjacent veſſels; the obſtructions likewiſe in the veſſels, which happen from the ligaments when they are diſtorted or diſtracted, fall here alſo under our conſideration.

Broken.] When a bone is divided into large pieces, it is called a fracture, which can never happen, but the veſſels which run between the lamellæ of the ſaid bone muſt be compreſſed and even deſtroyed: for the ſame reaſon, the veſſels of the perioſteum muſt alſo be neceſſarily compreſſed; eſpecially if the parts of the broken bone be removed out of their natural ſituation, in which caſe they cannot but compreſs all the parts that lie near it at the ſame time.

Disjointed.] When the head of an articulated bone falls out of the cavity it uſed to move in, it is called a luxation; but this connot be without the compreſſing of the ligaments that ſurround the joint, as alſo all the adjacent veſſels. Whilſt the head of the *os humeri* in a luxation lies in the arm-pit, it compreſſes the great veſſels there, and is attended with very bad conſequences, ariſing chiefly from the compreſſion of the great trunks of the nerves that are diſtributed through this part.

Diſtorted and diſtracted.] Diſtortion and diſtraction do not properly relate to the bones, but to the ligaments, by which they are connected. Diſtortion is a violence offered to the ligaments by the twiſting of the bones, while yet they retain their poſition. Diſtraction is when they are pulled by any great force, as by the lifting up too great a weight, in which caſe the ligaments of the joints are ſtretched out to a greater length. It is plain that neither of theſe caſes can ever happen, but many of the veſſels paſſing along the ligaments muſt be compreſſed and made narrower.

3. By every cauſe that draws the veſſels too much and lengthens them, whether it be a tumour, or the preſſure of a part that is out of its due poſition, or ſome external force that ſtrains them.

A flexible canal cannot be lengthened, but its cavity muſt be lengthened at the ſame time. This is plain to the eye, when glaſs tubes are lengthened at a lamp. An obſtruction indeed will not immediately happen in the larger canals from their being made narrower by lengthening, but it will eaſily happen in thoſe ſmall canals that tranſmit only ſingle elementary particles of the fluids through their extremities. In torturing malefactors, the ligaments of the joints are ſtrained by weights or pulleys, and the pain, inflammation, and redneſs which are diſcernible the next day, ſufficiently teſtify the obſtruction formed in the veſſels by their elongation. All tumours lengthen the veſſels of the parts where they are ſeated, by diſtending the membrane which ſurrounds them. The bones, muſcles, tendons, when out of their natural ſituation, produce the ſame effect. To this article alſo belongs all external force, that acts by lengthening the part.

4. By external compreſſion from ſtrait garments, bandages, or by the weight of the whole body lying on one part while at reſt, ligatures, *&c.* to this head alſo belong the motion, attrition, or ſqueezing of any part againſt other bodies.

In the former numbers, ſuch cauſes of obſtructions by ſtraitening the veſſels have been enumerated, as ariſe from the veſſels being ſwelled or thrown out of their proper poſition, and by this means compreſſing the adjoining veſſels; as alſo thoſe cauſes, that by lengthening the veſſels, leſſen their capacity. Under this head come all thoſe that render the veſſels narrower, by preſſing upon the external ſurface of the body.

Strait garments.] Theſe compreſs all the veſſels that are ſituated on the ſurface of the body; eſpecially the veins, as they are more eaſily to be compreſſed, and as they lie nearer the ſurface than the arteries; for the arteries are both ſtronger and more ſecurely placed. Now by this compreſſion of the veins, there is a greater quantity of blood thrown into the arteries; and of courſe the effects of a plethora are produced. If the veſſels then be ſo weak as to break upon the leaſt increaſe of the quantity or motion of the fluid contained in them, or if by being diſtended they diſcharge from their extremities into the cavities of the body the liquids which they naturally ought to retain, garments that are too ſtrait may by this means be the cauſe of conſiderable miſchief: eſpecially in ſuch perſons as are liable to ſpitting of blood or making bloody urine. And from this cauſe it is, that hyſterical women, hypochondriacal men, and aſthmatick people, *&c.* in whom the leaſt change of the ballance between the ſolids and fluids is apt to produce ſuch enormous effects, are ſo much relieved by letting looſe their garments, which before were wrapt too tight about them.

Bandages, ligatures.] Theſe have different effects according to the degree of aſtriction. If but moderately tight they confirm the lax diſtended parts, and ſupply the defect of the fibres when too weak; if they be drawn cloſer, they will contract the veſſels, and eſpecially the veins; if cloſer ſtill, they will render even the arteries narrower: whence inflammation frequently, and ſometimes even a gangrene, may follow. When the ſurgeons in order to retain a fractured bone, which they have reduced, in its proper poſition, amongſt other remedies have recourſe to bandages; if they be drawn too tight, within a few hours a tumour ſhall firſt ariſe in the part affected, and be afterwards followed by inflammation and a conſiderable pain: if in this caſe the ſurgeon cruelly neglects to hearken to his patient's complaint, he will have cauſe to lament his miſtake afterwards, when a gangrene follows upon it.

The incumbent weight, *&c.*] When ſick people become ſo inſenſible as not to feel the ſlight uneaſineſs to which the body is ſubject, as often happens to be the caſe in accute diſeaſes, or are obliged by reaſon of their ſevere pains, ſuch as the gout, rheumatiſm, *&c.* to keep in the ſame poſture, the whole weight of the body reſts upon the parts whereon they lie; by which means the veſſels contained in theſe parts are rendered narrower, and oftentimes ſo compreſſed, as to hinder the influx of the vital liquid, and ſo cauſe a gangrene and a ſphacelus. This caſe happens more eſpecially in thoſe parts, where the bones ſtand prominent and are covered with but few integuments, as about the *ſcapulæ*, the *os ſacrum*, the *os coccygis*, the rim of the *os ilii*, the trochanters of the thigh-bone, the heel, *&c.* but moſt frequently about the *os coccygis*; for when a man lies on his back horizontally, the bed is always more depreſſed in the middle but riſes on each ſide, ſo that the whole weight lies on the *os coccygis*, which is covered but with very little fat; by which means the parts upon the bone being deprived, in this compreſſion, of the influx of the vital fluid, die very ſoon. The only remedy is to oblige the perſon thus affected frequently to change his poſture, and to ſpread very ſoft leather under his naked body.

Motion, attrition, *&c.*] When any part of the body ſtrikes againſt an hard obſtacle, the yielding veſſels muſt of neceſſity be compreſſed; and this effect will follow, whether the part moved be directly thrown upon the reſiſting body, or be rubbed againſt it, or, laſtly, be ſqueezed hard upon it. Men that are not much uſed to walking, ſhall have their feet inflamed, if they take a long journey on foot; as thoſe that are not uſed to rowing, ſhall have their hands inflamed, that graſp the oars, and if they do not ſoon leave off, ſhall alſo have them bliſtered, and apt to gangrene.

## SECT. CXIII.

AN increaſe of the contraction proper to the veſſel, eſpecially in the ſpiral, as alſo in the longitudinal fibres, ſhall make the cavity narrower, and ariſes, 1. from all the cauſes which increaſe the elaſtick power of a fibre, canal, or viſcus (31, 36, 40, 50, 51): 2. from the ſwelling of the leſſer veſſels, when too full, whereof the ſides and cavities of the greater veſſels are compoſed: 3. By a diminution of the cauſe that extends the veſſels, whether it be inanition or inactivity: whence it is, that when the canals are cut aſunder, in a little time they become able to retain their own liquids again.

The proximate cauſe of all obſtructions is only one, which is always ſimple and the ſame, *i. e.* the greater bulk of the matter that is to be tranſmitted, above the capacity of the canal that is to tranſmit.

And the cauſes given of this were either the arctation of the canal, or the increaſe of the bulk to be tranſmitted through it. The firſt cauſe aſſigned for the arctation of the canal was external compreſſion, the cauſes of which have been reduced to four claſſes in the preceding paragraph. We are now to conſider that anguſtation of the canal, which ariſes from the increaſe of its contractive power.

That our veſſels have ſuch a power, is beyond all doubt; for it is by this power that the arteries contract to their former dimenſions, when the heart ceaſes to act, after they have been dilated by the blood thrown into them from the heart. And it is as certain that this contractile power may be increaſed. When a fat man recovers from an acute diſeaſe, in which he has loſt half his weight, his veſſels are all collapſed, yet a juſt circulation continues, which could not be if the veſſels were not full; and yet after the loſs of ſo large a quantity of liquids, the veſſels could not poſſibly remain full, unleſs they had contracted themſelves much more conſiderably, than they were uſed to before. But this power may alſo very ſuddenly increaſe. as we often ſee, though the quantity of liquids ſhall remain the ſame. If a man be ſtruck with ſudden fear, his face ſhall be all over contracted, his lips, cheeks, and eyes become pale, *&c.* the red blood be repelled by this contraction of the veſſels towards the inner parts, and collecting in the larger paſſages about the heart and lungs ſhall almoſt ſtagnate there; whence ſhall ariſe an intolerable anxiety, a palpitation of the heart, faintings, and other great diſorders, which ſhall often continue for the whole life after. It is certain therefore, that the veſſels have this power, and that it may be increaſed.

The principal cauſes are now to be conſidered, which may increaſe this contractile power belonging to the veſſels.

1. Whatever increaſes the elaſticity of the fibres muſt make them, and the veſſels compoſed of them, reſiſt the diſtending liquid the more; and when that diſtending cauſe ceaſes, muſt contract their cavity with a greater force. Theſe cauſes have been enumerated in the places here referred to; the repetition of one inſtance will at preſent ſuffice. Let an horſe be well fed and ſtand at reſt in the ſtable, his body will ſoon increaſe in bulk, and his lax veſſels be diſtended; but when exerciſed pretty ſtrongly every day, though his ſolid parts will be made more firm, he will look lanker, and the contractility of the veſſels being by this means increaſed, the accumulated liquid will be carried off.

2. It is now abſolutely certain from anatomical obſervations, that the membranes of the greater canals conſiſt of a wonderful texture of veſſels. Ruyſch has demonſtrated by his injections, that the branches of the coronary arteries are diſperſed through the membranes of the aorta, as likewiſe through all its larger branches (*a*). There is here alſo found a cellular coat, with follicles alſo for preparing and emitting that unctuous liniment, which covers the inſides of the arteries. Every ſort of tumour therefore mentioned §. 112. numb. 1. may take place here: for the arteries in theſe membranes may become aneuriſmatick, or

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(*a*) Epiſt. Anatom. Problem. III. Tab. 3. fig. 1, 2, 3.

or may be diſtended by an inflammation; the veins alſo may become varicous; the cells may grow into ampullary tumours; and the lymphaticks be turned into puſtules and hydatides. It is plain too, that if theſe veſſels which conſtitute the ſides of the greater canals ſwell, the cavity of the canal which they compoſe muſt be made narrower. In ſtags killed after a long chace, the external ſurface of the aorta has been found almoſt black, through theſe veſſels being too much filled with the red blood impelled into them. But it does not ſo clearly appear, how the tumour of theſe leſſer veſſels in the membranes ſhould increaſe the contractile power of the larger veſſels, ſince this depends on the elaſticity and muſcular action of the fibres only: but if it be conſidered, that the liquid impelled by the heart, and diſtending the greater canal, muſt by the ſame action preſs againſt the ſides of the ſame canal, and compreſs all the leſſer veſſels, diſperſed through its membranes, it will be plain, that when this action ceaſes, theſe veſſels will preſently be filled again, and ſo conſpire with the contractility of the veſſel to leſſen its cavity, and in this ſenſe the ſwelling of theſe veſſels, when too much filled, may aſſiſt the contraction of the greater veſſels, which are made up of theſe.

3. When the heart by its muſcular force expels the blood contained in its cavities, and throws it into the arteries which are always full, it follows of courſe, that theſe muſt be diſtended ſo much as to be capable of receiving all the blood that is thrown out of the heart; and thus the ſyſtole of the heart is one of the cauſes which extend the arteries. The arteries therefore are then in a violent ſtate, and as ſoon as the heart ceaſes to act, theſe re-act by their elaſticity and muſcular power, and ſo make their cavity narrower. But this cavity may be increaſed or leſſened, and yet the arteries be all the time full; for if the quantity of the contained liquid be leſſened, the veſſels contract the more. There are two cauſes therefore that di-

ſtend the arteries, the force of the heart propelling the blood, and the quantity of blood already contained in the arteries; if the force of the heart be leſſened, the whole circulation proceeds ſlowly; if the quantity of the diſtending liquid be diminiſhed, the fault lies in the inanition. In both caſes, the force which diſtends the veſſels is leſſened. But the capacity of all the veſſels depends on too oppoſite cauſes, the force and quantity of the liquid which is moved in the veſſel, and the contractile power of their ſides which reſiſts the diſtending cauſes; as ſoon therefore as the diſtending cauſes are leſſened, the contractile powers will produce the ſame effect, or, which is the ſame thing, the veſſels will be made narrower. For this reaſon, after death, the diſtending force of the heart ceaſing, the arteries become extremely narrow from their own contractility increaſed by the cold, and throw out almoſt all their blood into the veins, which are more eaſily to be dilated. It can ſcarce be conceived, how much the veſſels may be leſſened, when the diſtending cauſes ceaſe, or are much diminiſhed. When the humours are evacuated in great quantities both by vomiting and ſtool in a furious *cholera morbus*, the veſſels are preſently ſo contracted, that the pulſe can hardly be felt, the veins, which before were conſpicuous, now quite diſappear, and the face is ſo contracted and changed, that the ſick man's friends are ſcarce able to know him. The womb, which is ſo much diſtended in a ſtate of pregnancy, as ſoon as the fœtus and ſecundines are excluded, preſently contracts, and in a few weeks is reduced to a very ſmall cavity. More inſtances of this kind might be alledged, but theſe will at preſent ſuffice.

Whence it comes to paſs, that the canals, when they are cut in two, in a little time become able to retain their liquids.] The reaſon of this is plain; when the blood is thrown into the arteries by the force of the heart, the greater the reſiſtance is towards their extremities, the more it dilates them; but when an artery is cut aſunder, there is ſcarce any reſiſtance at all, for the blood in this caſe flows through the open wound; for which reaſon the artery is no longer diſtended but by the power inherent in it, and begins to contract itſelf by degrees, 'till at laſt it will ſuffer no more liquid to run out of it. And hence it is, that when any of the veſſels happen to be half cut through, a very obſtinate hæmorrhage ſhall enſue, which is moſt happily cured by cutting the adherent part entirely off, as will hereafter be ſhewn in the hiſtory of wounds.

## SECT. CXIV.

THE thickneſs of the membrane of the veſſel is increaſed, 1. By every kind of tumour (112. numb. 1.) riſing in the veſſels whereof the membrane is compoſed: 2. By all callus's formed there, whether cartilaginous, membranous, or boney (51).

1. Of this we have already treated §. 112. numb. 1. §. 113. numb. 2.

2. It has been ſhewn §. 39. that by the mere activity of life, the ſides of the ſmaller veſſels being deprived of their liquids will concreſce together, and that by this means chiefly the ſolid parts obtain their due ſtrength. In our tender age the veſſels being very weak eaſily give way to the diſtending fluid, and are lengthened in like manner; and for this reaſon the nearer a man approaches to his original the more he grows. In an adult perſon it was requiſite the body ſhould have a greater degree of firmneſs, and this it acquires from the concretion of the leſſer veſſels, and a true calloſity formed in various parts of it; this calloſity is proportionably greater, as the life has been longer and more active, 'till in decrepid old age, or ſooner by too great labour, there ariſes an univerſal

rigidity. But to preſerve the integrity of the functions, it is requiſite that the veſſels ſhould have a proper degree of flexibility, and this is diminiſhed by calloſity, and their cavity made narrower by an increaſe of thickneſs in the membranes which form it, when grown callous. We learn from the obſervations that have been made by phyſical writers, that the larger arteries in very old perſons have become as hard as a cartilage, and even as a bone. In the Philoſophical Tranſactions it is related, that in the body of an old man, who died at the age of one hundred and thirty, the aorta and iliack arteries were found almoſt cartilaginous (*a*). In that long-lived and much exerciſed creature a ſtag, the arteries have been often found boney at the baſis of the heart, which in the ſhops is called *Os de corde cervi.* But ſuch a bone has been alſo found in the midſt of the muſcular fleſh of the human heart, which was four inches and a half in length, and one inch in breadth, when yet the larger veſſels of the heart were not boney in the leaſt, only ſomewhat diſpoſed to be cartilaginous: nor could this circumſtance be imputed merely to the effects of old age, as it was found in the body of a perſon that did not exceed the age of two and ſeventy years (*b*).

## SECT. CXV.

THE ſize of the fluid parts is increaſed ſo as to become unpaſſable, either. 1. By the change of the ſpherical figure into another that ſhall preſent a larger ſurface to the aperture of a veſſel; or, 2. By the union of ſuch particles into one maſs as were before disjoined.

Having treated of thoſe cauſes of an obſtruction, which by contracting the cavities of the veſſels prove an

(*a*) Vide acta Lipſienſ. anni 1709, pag. 219.

(*b*) Academ. des Sciences Hiſt. pag. 34. l'an. 1726.

an impediment to the paſſage of the liquid that is to flow through them, it follows that we now conſider thoſe changes in the fluids that make them unable to paſs the narrow parts of the veſſels, through which in a ſtate of health they ought naturally to flow.

1. The human blood, as it comes out of the heart, is made up of particles of ſo many different ſizes, as there are different ſeries of veſſels; for through every decreaſing ſeries of veſſels there flow fluid particles of a proportional ſize. And this was neceſſary in order to the veſſels being all full: for if the red particles for inſtance were wanting, and there were no globules whoſe determinate ſize fitted them to paſs through the extremities of the red arteries only, and exclude them from every other veſſel of a leſs diameter, the blood would none of it ſtay in the great veſſels: and the caſe would be the ſame in the next order of decreaſing veſſels. It appears by the microſcope, that the ſmalleſt viſible particle of our circulating liquids are ſpherical; that they paſs in a manner ſingle through the extremities of the arteries, and even this oftentimes with a kind of difficulty: as therefore the figure of theſe particles is ſpherical, it is plain, that if a globule be ſmall enough to paſs a veſſel in one direction, it can with equal eaſe paſs it in any other. But this property is peculiar to a ſpherical figure only; for if ſuch a particle were of a cylindrick figure, and could paſs a veſſel if applied to its aperture by its baſis, it is plain it could not enter it in any other ſituation; as Pitcairn has moſt ſolidly demonſtrated in his Opuſcula (*a*). When the particles of our fluids loſe their ſpherical figure therefore, they alſo loſe the poſſibility of an uniform tranſition through the veſſels; for ſince by the motion of the heart and arteries, every particle of the blood has a different motion and ſituation every moment, it was requiſite to make this motion uniform, that they ſhould be of ſuch a figure as might enable

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(*a*) Diſſertat. de circulat. ſang. per vaſa minima, pag. 25, 26.

enable them to paſs through veſſels in any ſituation; which is the caſe of a ſpherical figure only.

2. The extremities of the red arteries are ſo ſmall, as to tranſmit but one red globule at a time; ſhould ſeveral of theſe therefore concreſce and unite together, they muſt obſtruct the orifice of the canal, which is only capable of tranſmitting them ſingly; and that the blood is very liable to concretions is plain, ſince it coagulates preſently if extravaſated, and even within the veſſels if it only reſts a little.

But there may ſeem to be another cauſe by which the particles of our fluids are ſometimes rendered unfit to paſs the minute extremities of the veſſels, *i. e.* by their being expanded into a greater bulk, whilſt the ſame quantity of matter ſtill remains. We learn by experiments, that heat enlarges and cold leſſens the ſize of all bodies; ſhould then the particles of the fluids be thus expanded by heat or any other cauſe whatever, as under a larger ſurface to contain only the ſame quantity of matter, they would not then be able to paſs through the extremities of the veſſels. But indeed it ſcarce ſeems probable, that any expanſion of the fluid particles, can ever be ſo ſtrong as to reſiſt the condenſation which they are ſubject to, from the action of the veſſels compreſſing them, eſpecially at their extremities: for there almoſt every ſingle particle touches the ſides of the veſſel, and is ſtrongly preſſed and condenſed by them; for in this manner it is by the action of the veſſels, that the chyle, which is more rare than blood, is changed into it. For which reaſon the celebrated author of the Aphoriſms has not aſſigned the rarefaction of the fluid particles, as one of the cauſes of obſtructions.

Some alſo have been of opinion, that the groſſer food mixed with the blood might cauſe an obſtruction. But the ſmallneſs of the abſorbent veſſels on both the inward and outward ſurface of the body prevents this; beſides, that whatever enters the blood muſt immediately paſs through the very minute veſſels of the lungs.

## SECT. CXVI.

THE chief cauſe of the change of figure in the particles is, when that equable preſſure fails which ought to act on every ſide at once, and equally on all the particles, by which means they are now left to their own elaſticity, and this is the caſe when either the motion is languid, or the veſſels are relaxed, or the quantity of liquid is diminiſhed.

As the arteries are already full, when the blood is thrown out of the heart into them, all the particles of the blood that was in them before cannot but be greatly compreſſed; and when this action of the heart ceaſes, the arteries again compreſs their contained fluids with violent force, by which means all the particles of the blood thus compreſſed by the action of the heart and arteries become condenſed. And for this reaſon the denſity of the particles of the blood is always proportional to the power of the heart and arteries: and thus ſtrong laborious people have the blood very denſe and ſolid, whereas it is thinner and leſs concreſcent in weak people. If blood be let within a few hours after a meal, a large quantity of chyle ſhall be found ſwimming upon the top of it; the chyle therefore is lighter than blood: and yet the ſame chyle, when it has been flowing with the blood eighteen hours or leſs, ſhall be changed by the action of the veſſels into ſerum and blood, and acquire a much greater degree of ſolidity; and conſequently the action of the veſſels condenſes the particles of the liquids. When the pellucid parts of animals are viewed through a microſcope, it is plain that the ſpherical elementary particles are ſometimes with difficulty preſſed through the extremities of the veſſels, and are changed from a ſpherical to a cylindrick figure, but that after they have got through theſe narrow paſſages, they ſhall recover their old figure again by their own elaſticity. Whence it appears, that theſe particles of our fluids are elaſtick, and that when freed from the compreſſion of the veſſels, they will expand into a larger bulk. Now whence comes it to paſs, that the ſhape of theſe elementary particles, ſo far as we can diſcern by the help of inſtruments, is ſpherical? If it be conſidered that the blood is thrown by the heart into a conical veſſel, that is reciprocally dilated and contracted, and incurvated as ſoon as it comes from the heart; it is plain that no particle of blood can keep the ſame direction for two moments together; and conſequently, that the particles muſt be continually ſtriking againſt each other: ſo that if any angular part ſhould ſtick out in any elementary particle, that point muſt ſuſtain the rotation of all the reſt, and therefore will ſoon either be beat off or ſmoothed down. Add to this, that the extremities of the arteries, if cut tranſverſly, have all a circular ſection, and ſo may give their figure to ſuch particles as are of a flexible nature. Thus ſoft clay or wax rolled in the hand will aſſume a ſpherical figure. But if the cauſes, that by an uniform preſſure do form and preſerve this ſpherical figure, ſhall ceaſe to act, the elaſtick particles will rebound and recede from the figure they have aſſumed.

Now the principal cauſe that produces this, is the too languid motion of the heart and arteries, from what cauſe ſoever it ſhall proceed. The reaſon of which is plain from what we have already ſaid, and the truth of the fact is confirmed by undoubted obſervations. Girls in the green-ſickneſs have a very languid circulation; whence ariſes an univerſal torpidneſs: and as the due diſcharge of the ſeveral functions depends upon the free paſſage of the fluids through the veſſels, all theſe functions, whether vital, animal, or natural, are either wholly deſtroyed or greatly diſordered; the blood departing from its due ſolidity becomes thin like water, or inert and viſcid, and uncapable of paſſing through the veſſels by reaſon of its glutinous tenacity. But when the action of the veſſels upon the fluids is increaſed by ſteel and exerciſe, the florid red colour is ſeen again; and a due denſity reſtored to the blood. In ſuch diſeaſes however as theſe, the obſtructions would be much more obſtinate, but that the veſſels being lax eaſily give way.

Veſſels relaxed.] The whole action of the veſſels on the fluids, is that force by which they endeavour to contract themſelves into a leſs ſpace, after they have been diſtended by the blood impelled from the heart, as has been obſerved and ſhewn before. But the ſtrength of the veſſels is leſſened by their being relaxed, and all the effects of courſe, which depend upon the due ſtrength of the veſſels.

Or the quantity of the liquid diminiſhed.] This will plainly appear, if we attend to the following conſiderations. The heart by its own force throws the blood into the arteries; the plenitude of the arteries, their elaſticity, and their converging extremities, reſiſt the blood that is thrown from the heart; for which reaſon the celerity of the blood flowing through the arteries, by the force communicated to it by the heart, will be proportional to the powers of the heart above the ſum of theſe reſiſtances: now the ſum of all theſe reſiſtances may be conſidered as a power propelling from the apex to the baſis of the conical artery; whereas the force of the heart acts in a contrary direction from the baſis to the apex; ſo that all the particles of the blood lie in a manner between two parallel planes preſſing againſt each other; from whence will ariſe the greateſt, and at the ſame time the moſt uniform compreſſion. If the fulneſs of the veſſels be diminiſhed, which has been aſſigned as one cauſe of the reſiſtance given to the heart, the compreſſion of the particles of the blood, will alſo be leſſened, upon which, their greater ſolidity did depend. Add to this, that when the quantity of the liquid is leſſened, the veſſels will be leſs diſtended, and ſo react leſs on the fluids they contain. And the ſame diminution of the quantity of the liquid, as has been proved before §. 25. numb. 1. and §. 43. numb. 3. will likewiſe weaken the ſtructure of the ſolid parts.

## SECT. CXVII.

THE particles are diſpoſed to run together and unite by reſt, cold, froſt, exſiccation, heat, by violent circulation and ſtrong compreſſing veſſels, by any acid, auſtere, ſpirituous, abſorbent, coagulating cauſe, by viſcoſity or oilineſs.

Two cauſes were aſſigned in §. 113, why the particles of the liquids might be ſo increaſed, as to render them unpaſſable, namely, a change in their figure, whereof we have treated in the preceding paragraph, and the coheſion of ſeveral ſmaller particles together, which before were ſeparate, the cauſes whereof are the ſubject of the preſent paragraph.

By reſt.] The cauſe of its fluidity does not lie in the blood itſelf; for when it drops from the noſtril of the moſt robuſt and healthy man into a clean veſſel, it preſently turns to a ſolid cake: ſome other cauſe therefore is required to keep the blood fluid, which is naturally ſo prone to coagulate, and this is its continual motion through the veſſels; for as ſoon as this ceaſes, it immediately forms itſelf into a ſolid maſs. Hence that incurable palpitation of the heart, which people who have often fainted away are ſo ſubject to, ariſing from the concretion of the blood, while it was ſtagnating about the heart and in its cavities, into polypous maſſes which can never after be reſolved. And for the ſame reaſon the like concreted maſſes are found after death in the heart and great veſſels of a body that was very ſound before. The ſtronger a man is the greater is the danger of concretion, if his blood be at reſt in the veſſels. And therefore thoſe faintings, which weakly girls are ſo ſubject to, and fall into upon every ſlight occaſion, are ſeldom ſo dangerous, as their blood is in too diſſolved a ſtate, and ſcarce ever or at leaſt very ſlowly concreſces, though it ſtand unmoved.

By cold, froſt.] When the blood flows from a vein into a clean veſſel, it is all coagulated within three or four minutes into a ſolid maſs, that adheres to the ſides of the veſſel. If the experiment be tried in a freezing air, it will congeal much ſooner, and the ſerum then will not be expreſſed. But it is not very eaſy to determine in what degree of cold blood will congeal, becauſe it concreſces ſo ſoon of itſelf even in a warm air; but the ſerum of blood will turn to ice when expoſed to the twenty-eighth degree of cold marked out in the Fahrenheitian thermometer; ſo that it requires a greater degree of cold than water, and probably becauſe it is enriched with ſalts. It is ſufficient here, that an increaſe of cold makes the blood to concreſce the ſooner. They therefore who continue ſo long in a ſwoon as to be quite cold, will find both the reſt and cold conſpire to produce irreſoluble polypuſes both about the heart and greater veſſels.

By exſiccation.] When the ſubtle part of our liquids is by any means whatever carried off, the reſt being grown thicker eaſily runs into concretions. Who would have thought, if we did not daily experience it, that the fine ſubtle dew that exhales from the extremities of the arteries in the cavities of the noſe and lungs, could turn to ſuch a tenacious and even coriaceous mucus, as it does when the thinner part of it is carried off? For the mucus that covers theſe parts is not ſuch at its firſt ſecretion, but a perfectly limpid humour, and afterwards thickens by ſtagnation. In deſperate conſumptions, where by the night-ſweats the blood is deprived of its diluting vehicle, it begins firſt to ſtick in the fine cutaneous veſſels, and forms inflammatory puſtules. For which reaſon Hippocrates condemns the falling into ſweats in the firſt ſtage of acute diſeaſes, both in the Prorrhetick and Coan Prænotions. So after death the blood appears frequently concreted in the arteries and not in the veins, becauſe the arteries being contracted both by their own elaſticity and the cold, drive the moſt fluid part into the veins.

By heat.] The moſt fluid ſerum of the blood coagulates in boiling water into a ſciſſile maſs: and in diſeaſes, where the heat very much exceeds the heat required in health, it ſhall immediately be diſpoſed to concretions. For this reaſon the reſpiration then begins to grow ſhort and difficult, and the actions of the brain to be diſordered, as the blood being now almoſt concreted cannot paſs thoſe very minute veſſels; add to this, that an increaſe of heat will carry off the parts that are moſt ſubtle.

By too violent a circulation, and ſtrong compreſſure of the veſſels.] The weaker the circulation is, the more diluted and thin is the blood, as appears in girls that are weakly: the more violent the motion of the humours is through the veſſels, the more thick and concreſcent is the blood, as is plain in men that are accuſtomed to hard labour. If blood be taken away on the firſt day of the ſmall-pox, it ſhall look well to the eye; if on the third or fourth, it ſhall be covered with an inflammatory cruſt, becauſe the moſt liquid parts being carried off by the fever, and the thicker parts more cloſely compacted, the particles of blood begin to cohere more firmly together; for whilſt there is a large quantity of thin liquid interpoſed between the thicker parts, the preſſure of the veſſels will not change their figure; but when this is carried off, the thicker parts of the blood becoming contiguous will be forcibly compreſſed by the action of the veſſels, loſe their ſpherical figure, touch each other in many points, and run into concretions. For when the veſſels are very ſtrong, ſo as to compreſs their fluids with great force, the fineſt part will be carried off, and the thicker parts united by this compreſſion.

An acid coagulum.] All acids do not coagulate the blood: for the acidulous wines, juices of ripe acid fruits, vinegar, butter-milk, *&c.* rather diſſolve it: but the foſſile acids that are prepared from ſea-ſalt, nitre, *&c.* will coagulate it. If theſe be injected into the veins of a living animal, the blood preſently will form itſelf into thick lumps, and theſe will paſs through the veins as they grow continually larger to the right ventricle of the heart, and thence into the lungs, where they will bring on a moſt dreadful anxiety, and ſoon after death. However, the orifices of the bibulous veſſels are ſo formed as not to admit eaſily theſe very acrid acids, as they will conſtantly contract and cloſe when expoſed to much gentler *ſtimuli.* When the atrabiliary humour, which is ſometimes ſo acid as to eat into the pavement like *aqua fortis,* erodes the veſſels and mixes with the blood, it ſhall frequently occaſion ſudden death by coagulating the blood.

Auſtere.] Such as allom in particular, and the various ſorts of vitriol, which produce the ſtrongeſt coagulations.

Spirituous.] It is a known fact in ſurgery, that alcohol applied to the bleeding mouths of divided veſſels, ſhall put a ſtop to the moſt violent hæmorrhages by coagulating the blood. The ſerum of the blood itſelf will preſently become hard by pouring alcohol upon it. Whence we ſee how great the danger is, which ariſes from an exceſſive uſe of ſpirituous liquors. Upon another occaſion we gave an extraordinary inſtance §. 28. numb. 4. of the viſcera of a drunken woman, which were all found ſchirrous and indurated.

Abſorbent.] There are ſome ſuch thirſty bodies as attract all the moiſture near them to themſelves; ſo *gypſum*, quick-lime, the burnt bones of animals, the ſeveral clays baked in a ſtrong fire, will imbibe all the liquids they approach. Such ſubſtances, if mixed with our humours, will cauſe them to run into concretion by abſorbing the thinneſt parts of them. However they are ſeldom mixed with the blood with this quality entire in them, becauſe they are neceſſarily ſaturated with the liquids they meet with before. And yet in the firſt paſſages they are capable of bringing on very ſevere diſeaſes, and even death itſelf. Pliny relates, that C. Proculeius, when tormented with a violent pain in his ſtomach, killed himſelf by drinking of gypſum (*a*). Dioſcorides tells us, that a man may be ſuffocated by drinking of gypſum (*b*).

Viſcoſity.] How this may cauſe obſtructions has been already ſhewn in the chapter of the diſeaſes ariſing from a ſpontaneous gluten, eſpecially in §. 72.

Oilineſs.] In fat people, when the fat is melted by violent exerciſe, the intenſe heat of the air, or acute fevers, and ſo thrown back into the blood, it ſhall often occaſion ſudden death, the viſcidity of the oily matter obſtructing the veſſels and preventing all other liquids from paſſing through them. Whence frequently ariſes of a ſudden a fatal peripneumony, from the obſtruction hereby formed in the narrow paſſages of the pulmonary artery, when thus obſtructed.

## SECT. CXVIII.

THE parts of a fluid become unable to paſs by error of place, when a corpuſcle ruſhes into the dilated mouth at the baſis of a conical canal, and cannot paſs through the narrow end of it. A plethora, an increaſe of motion, a rarefaction of the liquid, and relaxation of the veſſel,

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(*a*) Lib. XXXVI. cap. 24.

(*b*) Lib. V. cap. 134.

ſel, are the principal cauſes that create this dilatation; eſpecially if when theſe have gone before, their contraries preſently ſucceed.

Hitherto we have treated of the cauſes of an obſtruction, which either leſſen the cavity of the veſſel, or render the liquids contained in the veſſels incapable of paſſing through them, by an alteration in the figure of the particles, whereof the fluid is compoſed, or by the joining of them more cloſely together. There now follows another kind of obſtruction, wherein though the veſſels retain their due amplitude, at leaſt are not too narrow, and the properties of the fluids are altered in no reſpect, an obſtruction ſhall be found notwithſtanding, namely, whilſt the thicker parts of the fluids only enter the dilated orifices of the leſſer veſſels, and cannot paſs through their extremities, but remain fixed in veſſels which do not belong to them. And as in this caſe there is nothing amiſs but their admiſſion into an improper place, this cauſe of an obſtruction is termed an *error in place*.

This cauſe of obſtruction is not often mentioned by phyſical writers, though it be very frequently the cauſe of death in acute diſeaſes. As the Antients were ignorant of the circulation of the blood, it is but very obſcurely hinted at in ſome particular places. Galen, deſcribing the nature of a phlegmon, ſays (*a*), *Quam ſanguis calidus copioſior in aliquam animalis partem procubuit, majora ejus vaſa protinus diſtenduntur, quæ plenitudinem non ferunt; ab his deinceps, quæ minora ſunt; mox ubi nec in iis ſatis continetur, exudat foràs in illa ampla ſpatia, quæ inter vaſa ſunt, ſic ut etiam omnia, quæ in compoſita carne habentur, loca occupet*; "When the hot blood falls on a particular "part more copiouſly, its great veſſels are preſently "diſtended, and theſe not being able to bear the plenitude, ſoon after it enters thoſe that are leſs; and "not

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(*a*) Meth. Med. Lib. X. cap. 6. Charter. Tom. X. pag. 233.

" not being capable of being contained here neither, " it ſweats out into thoſe large ſpaces which lie between the veſſels, ſo as to fill up all the vacuities in " the ſolid fleſh." Whence it may be concluded, that in a phlegmon the blood enters into veſſels, which do not belong to it.

But to make this matter very plain, what follows deſerves conſidering.

The largeſt particles in the blood are the red globules, which naturally are to be found in the greateſt veſſels only. Now the extremities of the arteries charged with red blood tranſmit the red globules ſingly, and with ſome difficulty, as has appeared by the obſervations made of the circulation in the pellucid parts of living animals when viewed through a microſcope. All the finer parts are conveyed out of theſe red arteries into the ſmaller lateral veſſels, that riſe from the former; and as the red blood paſſes through the extremities of theſe arteries, ſo the red vein receives this red blood only. The veſſel of the next magnitude receives all the liquids but the red blood, and retaining the thickeſt parts only, *i. e.* the ſerous globules, tranſmits the remaining thinner liquids into the ſmaller veſſels, that riſe from this ſerous artery. And thus from analogy it is probable, that the ſame law obtains in all the decreaſing ſeries of veſſels. Through every one of theſe veſſels therefore of different magnitude, there flow ſome particles too large to enter the ſmaller veſſels, and theſe particles conſtitute the fluid which naturally and properly belongs to the ſeveral ſeries of veſſels. Thus the largeſt veſſel is capable of tranſmitting every humour; but the leſſer veſſel tranſmits only all the thinner liquids together with its own natural liquid, from whence it has its name. The red arteries can receive and tranſmit all the humours; the ſerous arteries exclude the red part of the blood, but tranſmit the ſerous globules, and every other thinner fluid. Now the extremity of a red artery, where it paſſes into a vein, ought to be larger than the mouth of a ſerous artery ariſing from it, elſe the red blood would not continue in its proper veſſels, but would paſs into the ſerous arteries; ſo that the leaſt red artery is the leaſt of all the greater veſſels, and the largeſt of all the ſmaller.

Should now the diameter of a lateral veſſel ariſing from a larger veſſel be by any means whatſoever increaſed, *e.g.* the aperture of a ſerous artery, which has its riſe from a red one, a red globule might be able to enter its orifice when thus dilated; but as a conical canal always grows narrower, it will ſhortly ſtick faſt and be by no means able to paſs through its extremity, and conſequently will cauſe an obſtruction, as the bulk of the particle to be carried through exceeds the capacity of the tranſmitting veſſel. This may happen wherever a ſmaller veſſel ſprings from a greater; and be of as many ſorts as there are differences in the magnitudes of the decreaſing particles in the blood, excepting the thinneſt fluid of all in the whole body, for this will paſs though the minuteſt veſſels, and can never cauſe an obſtruction by *error of place.*

The cauſes that increaſe the capacity of the veſſel are chiefly theſe which follow.

Plethora.] When there is too much blood in the body, the veſſels that contain red blood will ſwell, and being thus increaſed in bulk will compreſs the ſmaller adjacent veſſels; but whilſt a red artery by being too much filled with blood is diſtended, the ſides of the ſaid veſſel muſt of neceſſity be drawn farther aſunder, and conſequently the orifices of the ſmaller veſſels that riſe from theſe ſides will be dilated, and admit thicker particles than ſuch as they ought naturally to contain. Thus the *tunica adnata* of the eyes, which naturally has no red blood-veſſels, is very apt to be red in plethorick people.

Motion increaſed.] How this may enlarge the orifices of the veſſels, and impel thicker liquids, into the ſmaller veſſels, has been already explained, §. 100.

Rarefaction of the liquid.] If the bulk of the liquid be increaſed by an increaſe of heat, or any other poſſible cauſe whatſoever, while the quantity of matter remains the ſame, it muſt dilate its containing veſſel; which will then admit of thicker particles than it naturally ought to contain. When a man ſits by the fire, the heat will make the external parts to ſwell and grow more red than naturally they were wont to do.

Relaxation of the veſſel.] The amplitude of the veſſels depends on two very oppoſite cauſes. The liquid impelled by the heart endeavours to dilate the canals, and theſe by the ſtrength of their fibres reſiſt the impelled liquid. If theſe two powers were equal, the canals would always continue in the ſame degree of amplitude. But if the impetus of the liquid prevail, the canal will be dilated, and ſo much the more in proportion as the impetus of the impelled fluid exceeds the reſiſtance of the ſides of the canals. If this reſiſtance therefore be leſſened through the relaxation of the veſſel, the impelled liquid will the more dilate the canals, and ſuch particles of the fluid be able to enter them as were before excluded. If any part of the body be expoſed for a long time to the vapour of warm water, it will ſwell and grow red, the red blood being entered into the ſmaller veſſels dilated. This is the reaſon that the *tunicæ adnatæ* ſo often become red, becauſe though naturally there is no red blood in them, yet they conſiſt of veſſels that are very eaſily dilatable. Hence Hippocrates reckons opthalmies among the epidemick diſeaſes, that reign in a warm moiſt ſoutherly ſeaſon without winds (*b*); as ſuch a ſtate of the air relaxes the body more than any other.

Eſpecially if theſe have gone before, their contraries follow.] When a man grows hot by exerciſe, the force and velocity of the humours being increaſed hereby, the dilated veſſels receive other humours than naturally

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(*b*) Epidem. 3. Charter. Tom. IX. pag. 261.

naturally belong to them; and thus the whole ſkin throughout the body becomes red after violent running: but by reſt in a warm air, and keeping the body well covered, the celerity of the motion of the blood abates, the veſſels contract and repel the thicker particles, which were impelled into them, back into the broader veſſels, and by degrees every thing returns to its former ſtate: but if the body be expoſed to a cold air when it is thus heated, or the man drink cold water, what terrible miſchiefs will enſue? for the veſſels being contracted by the ſudden cold, retain the thicker fluids that have entered them, and cannot paſs through their very narrow extremities, whence ſevere inflammations follow, and oftentimes ſudden death. How often does it happen, that country people, to quench their thirſts in the ſummer-heats after violent labour, greedily ſwallow ſome cold liquor, and die ſuddenly, or have every function ſo changed, that ſcarce any appearance of their former health ſhall remain? When Alexander, covered with ſweat and duſt, went into the Cydnus to waſh himſelf in a very hot country, and the hotteſt time of the day; (c) *vix ingreſſi ſubito horrore artus rigere cœperunt, pallore deinde ſuffuſus eſt, & totum propemodum corpus vitalis calor reliquit. Expiranti ſimilem miniſtri manu excipiunt, nec ſatis compotem mentis in tabernaculum deferunt*; "as ſoon as he entered the water his limbs "grew ſtiff on a ſudden, and he turned pale all over, "and the vital heat forſook almoſt every part of "his body. His ſervants received him like a dying "man, and carried him ſcarce ſenſible to his tent." So ſuddenly was his ſtrength deſtroyed, young and hardened as he was by warlike toils, a violent diſeaſe immediately ſeized him, who was perfectly well before, from which he very difficultly eſcaped by the ſkill and fidelity of Philip his Phyſician.

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(c) Q. Curt. Lib. II. cap. 5.

## SECT. CXIX.

FROM whence appear the cauſes and nature of every obſtruction.

The nature of an obſtruction conſiſts only in the obſtacle given to the paſſage of the fluid through the veſſel, and the ſeveral cauſes have been recited, which either act by making the veſſels narrower, or by inſpiſſating the liquids, or by doing both together at the ſame time.

But it ſtill remains a doubt, whether an obſtruction may be formed in every kind of veſſels. That it may ariſe in conical veſſels through which the liquids are moved in a direction leading from the baſis to the apex, is certain; for the particles of the fluid arrive at a narrower ſection of the cone every moment; and that which paſſed freely at the baſis, may eaſily ſtick in the extremities of this converging canal, and then the liquid behind will always preſs the unpaſſable maſs into a ſtill narrower ſpace, and ſo increaſe the obſtruction. In cylindrick canals, or, as Pitcairn phraſes it, in canals whoſe ſides are parallel to the line of motion, an obſtruction may by accident happen, though not ſo eaſily perhaps; for being every where of the ſame amplitude, the particles that could once enter it may alſo paſs through. Yet the particles of the fluid are capable of becoming larger by rarefaction, and ſo for inſtance may paſs more difficultly, but the liquid urging behind would be able in all probability to overcome this reſiſtance. We may conceive indeed, that a fit particle to paſs through a cylindrical canal, by having its bulk increaſed or being united to others, may poſſibly diſtend ſome part of the veſſel, ſtick there, and ſo obſtruct it; but then it would no longer be a cylindrical canal, no having the ſame amplitude in all places, and the obſtructing matter would be driven by the direction of its motion from a larger to a ſmaller ſpace and then this would be the ſame caſe, as we have already deſcribed, in ſpeaking of the arteries.

But in the veins, where the direction of the motion tends from the apex of a conical canal to its baſis, an obſtruction ſeems not poſſible, unleſs by the external compreſſion of the veſſel; for whatever has paſſed the narrow orifice of its vertex, will eaſily paſs the other ſections of the canal, which are continually growing larger; and though the particles of the fluid be ſuppoſed to unite into ſtill larger particles, yet as theſe are not ſupported by the diverging ſides of the veins, they will eaſily be carried along by the impetus of the ſubſequent liquid; as Pitcairn has fully proved in his Diſſertations (*a*).

This is farther confirmed by the experiments made on living animals. I injected alcohol into the crural vein of a dog, and though the blood was immediately coagulated into lumps, yet theſe were carried along the whole length of the vein to the right ventricle of the heart, from whence being driven into the lungs, there they ſtuck, and raiſed the utmoſt anxiety; and though all the efforts of reſpiration were uſed by the dog to make them paſs theſe narrow veſſels, he preſently died. Since therefore ſo ſtrong a coagulant cauſed no obſtruction in the veins, it is much leſs likely to ariſe from any ſlighter cauſe.

So that an obſtruction does not ſeem poſſible to be formed in canals, through which during the courſe of life the liquids are carried by a perpetual motion, unleſs the direction of the motion be from a broader orifice to a narrower.

Nor is it any objection, that the hepatick duct, as alſo the *ductus communis choledochus*, which have ſomething of the nature of veins, are often obſtructed, though they convey the liquid ſecreted by the liver from narrower paſſages into a larger duct; for the

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(*a*) Diſſertat. de circulatione ſanguinis in animalibus genitis & non genitis, pag. 107, 108, 109.

the *ductus communis*, after it has pierced the firſt coat of the duodenum, deſcends a ſmall ſpace between this and the next; and then piercing the other, it runs a conſiderable length between the ſecond and third, and then at laſt opens into the cavity of the inteſtine. Now a great many cauſes may occur to render this orifice narrower, or even quite to cloſe it, and by this means interrupt the free courſe of the bile, which is apt to run into concretions when it ſtagnates, as anatomical obſervations have ſhewn.

It is certain however, that polypous concretions and obſtructions ariſing from thence, may ariſe in the larger receivers and ſinuſes, where the venal blood is collected, and may continue for a time.

## SECT. CXX.

WHICH as ſoon as it ariſes in a living ſubject, hinders the paſſage of the matter that ought to flow through it, ſtops all the fluids ſtriking againſt it, and ſuſtains their action; hence it cauſes the thinner parts to be expreſſed; the thicker parts to be united; the veſſel to be extended, dilated, attenuated, and broken; the ſtagnating fluid to be condenſed; the function that depended on the integrity of the veſſels to be deſtroyed; the veſſels that are waſhed by it to be emptied and dried; the capacity of the veſſels to tranſmit the liquids to be diminiſhed; the quantity of liquids and their velocity in the veſſels that are free and open to be increaſed, and of courſe all the miſchiefs that may ariſe from hence.

Having already explained the cauſes and nature of an obſtruction, we are now to examine the effects, which will follow from an obſtruction conſidered as a cauſe.

Which as ſoon as it ariſes in a living ſubject, hinders the paſſage of the matter that ought to flow through it.] For in a dead carcaſe, where there is no motion of the liquids through the veſſels, an obſtruction will do no miſchief. This is plain from the very definition of an obſtruction §. 107. where an obſtruction was ſaid to occur, when the paſſage of a liquid through its canal was ſtopped, from what cauſe ſoever it might proceed.

It ſtops all the fluids ſtriking againſt it, and ſuſtains their action.] Whilſt life ſubſiſts, the fluids are carried through the veſſels with a continual motion and conſiderable force; for, as we have obſerved upon another occaſion, when a toe is cut off, the blood will fly out from the divided arteries to the diſtance of two feet and upwards. When therefore a canal is obſtructed, the liquid is driven againſt the obſtructed place, with a like quantity of motion to that which would carry it to the extremities with a proportionable degree of celerity; and this force, thus acting upon the obſtructed place, is renewed at every contraction of the heart and arteries. And as the obſtruction is formed in a conical canal, through which the liquid is driven from the baſis to the vertex, it is thruſt onward every moment into a ſtill narrower place. And thus both all the liquid that ſtrikes againſt it is ſtopped at the obſtructed place, and the matter that obſtructs continuing unmoveable, muſt of courſe ſuſtain the whole impetus of the liquid that preſſes from behind.

The thinner parts are expreſſed, and the thicker united.] An obſtruction ſeldom takes place (unleſs from external compreſſion or by error of place) but in the extremities of the veſſels. What then will be the conſequence, if, for inſtance, it happen at the extremity of a red artery? The blood has in it ſeveral fluids conſiſting of leſſer particles, and every larger canal has alſo ſmaller branches iſſuing from its ſides, which are capable of tranſmitting the moſt fluid parts, but not the thicker. When then the action of the heart and arteries propels the blood againſt the obſtructed

ſtructed place, the thinneſt fluids being placed as it were between two oppoſite preſſes, will paſs into the ſmaller lateral canals, and the thicker parts only will remain, be preſſed againſt the obſtructed place, and increaſe the obſtructed matter. But ſound blood of itſelf naturally tends to concretion, and eſpecially when deprived of its thinner part, and ſo the miſchief will be by this means increaſed. When in a true phrenitis, the blood flowing in the carotid and vertebral arteries is ſtopped at the extremities of the veſſels, and can paſs no farther, the heart perſiſts in propelling more blood, and it may be as yet ſound blood too, through the arteries every moment; but the moſt liquid parts are all the while expreſſed into the lateral branches, and the thickeſt are accumulated, 'till at length the greater part of the veſſels in the cortical ſubſtance of the brain are plugged up, and the diſeaſe rendered incurable. For which reaſon it is ſo bad a ſymptom in a peripneumony, if the blood drawn from a vein be too dilute and ſcarcely diſpoſed to coagulate; as this ſhews, that the thinner parts only paſs through the lungs, while the thick are accumulated.

The veſſels extended, dilated, attenuated, broken.] When the heart propels the blood into the arteries, they are diſtended, both becauſe they are already full, and becauſe the liquid impelled is greatly reſiſted by their converging extremities. For if they were empty, or there were no reſiſtance at their extremities, the blood impelled from the heart into the arteries would flow freely through them, and not preſs their ſides to recede from the axis of the canal. The fuller therefore the arteries are, and the greater reſiſtance there is at their extremities, the more they are dilated by the blood driven from the heart: but an obſtructed canal is full in the place that lies before the part where it is obſtructed, and withal the greateſt reſiſtance is there given to the impelled liquid; whence its dilatation muſt neceſſarily follow. When the free courſe of the blood in the veins is interrupted by a ligature, they preſently ſwell juſt below it; but when a veſſel is extended, the ſolid fibres of its ſides are drawn to a greater diſtance from each other, the points of contact are leſſened, and the coheſion debilitated, as has been already explained §. 25. numb. 3. The ſides therefore of the veſſels are leſs able to reſiſt the cauſes which diſtend them, and for this reaſon are ſtill more dilated, 'till at length there is no coheſion at all, that is, a rupture enſues. If it be now conſidered, that an obſtruction is ſeldom formed in the greater veſſels, and almoſt conſtantly in the leaſt; and that the largeſt of theſe leaſt, *i. e.* the extremities of the red arteries are not equal to the tenth part of an hair, the great danger of their rupture when obſtructed will eaſily appear: but this danger will be ſtill much greater if the obſtruction be in the ſerous or lymphatick arteries, *&c.* For this cauſe it is, that when a violent inflammation has continued for four or five days, upon a rupture of the very ſmall veſſels that were obſtructed, occaſioned by their being too much diſtended, a gangrene or at leaſt a ſuppuration follows; and in this caſe it would be in vain to expect that the obſtructed matter ſhould be diſcuſſed.

But the veſſels that are obſtructed, and by that means dilated, muſt neceſſarily compreſs the other veſſels that lie next them, and of courſe cauſe alſo obſtructions in them too, and thus the miſchief ſpreads.

The ſtagnating fluid is condenſed ] By the expreſſion of the moſt liquid part, and the compaction of the thicker part; as has been obſerved before.

The function that depended on the perfect circulation through the veſſel is deſtroyed.] Thus we begin to ſee how many kinds of diſeaſes may ariſe from an obſtruction only; for as all the functions depend on a free circulation of the fluids, when this is interrupted, they are all diſordered, or quite ceaſe. If any polypous maſſes concreted near the right ventricle of the heart ſhall paſs into the lungs, life would ceaſe at once. Should the branches of the *vena porta* in the liver be obſtructed, no bile would be ſecreted, *&c.* Since therefore an obſtruction may ariſe from ſo many cauſes, it may perhaps ſeem ſtrange, that the functions are not more frequently deſtroyed or diſordered hereby, as in all probability ſome veſſels or other, diſperſed through the ſeveral viſcera, are frequently obſtructed; but anatomiſts have taught us, that the veſſels in the viſcera almoſt every where communicate by their branches; and hence though ſome ſhould be obſtructed, yet the circulation continues free in the reſt, nor is the proper function of the viſcera immediately diſordered upon every ſlight obſtruction.

The veſſels that are ſupplied from it are emptied, dried.] In many parts of the body as the blood is brought by a ſingle veſſel only; *v. g.* each kidney is ſupplied with blood by a ſingle artery, and ſo the axillary arteries provide one for each arm, *&c.* ſhould theſe be obſtructed, it is plain, that no other ſupplies could be conveyed to theſe parts, which derive from hence their vital blood. But when the veſſels are no longer diſtended by any liquids, they will collapſe or contract themſelves at leaſt to their ſmalleſt diameter. Should the obſtruction be removed in the larger veſſels, the liquid ruſhing in with a violent force would diſtend them again, whether collapſed or contracted; but ſhould the ſmalleſt veſſels thus collapſe from a like cauſe, and continue in this ſtate for ſome time, their ſides would ſoon grow together, and remain unpaſſable during life, and their functions, depending upon a free paſſage of the liquids through them, would all be loſt. It often happens, that acute inflammatory diſeaſes of the head, ſhall leave behind them incurable deafneſs or blindneſs during the whole life after; the reaſon of which probably is this, that when the greater veſſels were obſtructed by the inflammation, the leſſer ones derived from them, being compreſſed or collapſed, were by this means grown together. When in an apoplexy the ſeveral actions of the brain ceaſe to be performed, it is ſeldom cured, without ſome defect in one or other of the functions, which for the moſt part proves incurable.

The capacity of the veſſels cannot tranſmit the liquids diminiſhed; the quantity, *&c.*] When the obſtructed veſſels cannot tranſmit the liquid impelled by the heart, whatever cannot paſs through the obſtructed veſſels muſt be contained in thoſe which have their paſſage open; for as the obſtruction is almoſt always in the arteries, all that lies behind the obſtructed place in the arteries, will return by the veins to the heart, for theſe are eaſily emptied; ſo that there will remain the ſame quantity of liquid to be moved, though the number of the canals in the mean time be leſs; by which means if any part of conſequence in the body ſhould chance to be obſtructed, the other parts would neceſſarily be diſtended with a greater quantity of liquid, and ſuffer all the effects of a plethora; and farther, all this over-ballance of liquids muſt either remain in the diſtended veſſels that are free and open, or the velocity of the circulation muſt be ſo increaſed, as that, the ſame quantity of liquid remaining, the heart may in a given time propel the blood through a leſs number of canals. Opening the abdomen of a living dog, I made a ligature round the trunk of the deſcending aorta: by the ſtruggles of the animal ariſing from the pain it was in, all the blood of the lower parts quickly returned to the heart, whilſt the leaſt drop of blood could not be tranſmitted to the parts below: the poor creature ſoon fell into exceſſive agonies; his heart beat violently, his eyes ſtarted almoſt out of his head all ſtreaked with blood, his tongue was turgid with blood and hung out of his mouth, a large quantity of froth was gathered about his mouth, and he ſoon after died. When the ſtomach is diſtended with a large quantity of meat and drink, and preſſes the deſcending trunk of the aorta, the turgid face, the red eyes, the increaſed pulſations, and the quicker reſpiration,

ſpiration, all ſhew the quantity of blood to be increaſed in the upper parts, and that it flows with greater celerity through the veſſels; hence it is that we meet with ſo many inſtances of perſons, who have died of an apoplexy immediately after a full meal, among the writers of obſervations.

And thus all, *&c.*] Which are certainly without number; as all the functions depend on a free paſſage of the fluid through the veſſels; but an obſtruction when formed, and interrupting the free paſſage, is capable of diſordering both all the functions in general, and every diſtinct function in particular; and as a diſordered function is a diſeaſe, there may therefore as many diſeaſes proceed from an obſtruction, as there are functions to be diſordered.

## SECT. CXXI.

FOR which reaſon, according to the diverſity of the obſtructed veſſels and the obſtructing matter, thoſe effects (120) ſhew themſelves in different ſymptoms.

As the great number of diſeaſes, that may ariſe from obſtructions, hinders us from deſcribing every particular diſtemper, it will ſuffice to ſet down the principal heads upon which the different effects of an obſtruction depend. For the ſymptoms will be quite different, when an inflamed blood, rendered uncapable of paſſing by reaſon of its thickneſs, obſtructs the very tender veſſels in the cortical ſubſtance of the brain, or the much firmer ones in the kidneys. We have reaſon to hope, that ſuch an inflammatory obſtruction in the cortical ſubſtance of the brain will be much more eaſily cured, than if an atrabilious matter were to obſtruct the ſame veſſels with its pitchy tenacity. For the obſtructing matter is ſometimes of ſuch a nature, as to diſſolve by degrees, if not too much preſſed from behind by the impetus of the vital humour, and ſometimes reſiſting all endeavours to remove it, it will bring on an incurable diſeaſe. If a confirmed ſchirrhus, or a malignant cancer, that will not admit of being extirpated, are the cauſe of an obſtruction, he muſt be a bold man that in ſuch a caſe will preſume to promiſe a cure.

## S E C T. CXXII.

IN the arteries which carry red blood may ariſe an inflammation of the firſt ſort: in the yellow ſerous arteries may ariſe either a red inflammation by error of place, or the yellow one proper to that veſſel, known by its being hot and yellow: in the lpmyhatick arteries may ariſe either the yellow inflammation of the ſecond ſort, by their being ſo dilated, as to admit of foreign particles by an error of place, or the pellucid hot ſort proper to that veſſel: in the larger arterial lymphatick veſſels there may ariſe the hot œdema; in the leſſer ones pains without any apparent ſwelling. The pinguiferous, oſſeous, medullary, nervous, bilious veſſels, have each of them their diſtinct kinds.

In the arteries which carry red blood may ariſe an inflammation of the firſt kind.] The general idea of every obſtruction ſuppoſes, that the bulk of the ſubſtance that is to paſs, exceeds the capacity of the veſſel through which it is to paſs, as has been defined §. 107. This therefore may happen in every veſſel through which a liquid flows, in the leaſt no leſs than the greateſt, but the red blood naturally is found only in the largeſt veſſels; ſo that if any obſtruction be formed in theſe canals, the thickeſt part of the blood, that is, the red, will ſtop in the extremities of theſe veſſels; if the force of the vital liquid preſſes upon the obſtructing matter from behind, it will form an inflammation in the largeſt of the ſmaller veſſels, and will be called an inflammation of the firſt kind. But as the ſmaller orders of veſſels take their riſe from the larger, if the circulation of the humours be interrupted in theſe, nothing hardly can enter the leſſer veſſels derived from them, and conſequently death muſt ſoon follow, either of the whole or of the part.

In the yellow ſerous arteries a red inflammation by error of place, or the yellow kind proper to that veſſel, which is hot and yellow.] The next veſſel in ſize to the red veſſel is the ſerous, which receives every other part of the fluid except the red; and yet if they be dilated near their origin, theſe ſerous veſſels may ſometimes admit the red globules, though not tranſmit them through their extremities; and thus this will form an obſtruction by error of place, as we have obſerved §. 118. and in this caſe there will be a red inflammation ariſing from an obſtruction in veſſels that are naturally not red. But as the thickeſt part of the blood, by the change of figure or the union of its particles, may cauſe an inflammation in the greater veſſels peculiar to the ſaid veſſels; ſo may the thickeſt part of the liquid, that flows in the ſerous arteries, if ſtopped at their extremities, cauſe an inflammation peculiar to theſe veſſels; and as this may happen, though no red blood gain admittance into theſe veſſels; ſo this inflammation will not be red but yellow.

In the lymphatick arteries dilated a yellow inflammation of the ſecond kind by error of place; or a pellucid hot kind peculiar to this veſſel.] The next veſſel in ſize to the ſerous, carries a liquid that is not diſtinguiſhable by any colour, the red and the yellow parts being excluded by the narrowneſs of theſe veſſels, but a ſerous yellow particle may enter their orifices dilated, and thus cauſe a yellow inflammation by error of place. The thickeſt part alſo of this liquid may become unable to paſs the lymphaticks by the common cauſes of obſtructions, and ſo make an inflammation peculiar to theſe veſſels. The ſame doctrine may likewiſe be applied to all the decreaſing orders of veſſels, of which we can ſay nothing but by analogy only, there being no anatomical views of them to be taken.

Hence it appears, that the red blood-veſſels admit but one ſort of inflammation, *viz.* that which ariſes from their own proper liquid being grown unfit to paſs; but the reſt of the ſmaller veſſels may admit of two ſorts, one from an error of place by receiving a thicker liquid into their dilated orifices; the other from their own liquid grown incapable of paſſing through them.

In the larger lymphatick arteries an hot œdema.] How far this diviſion of the veſſels into finer is continued no one can tell. The large veſſels when they are inflamed, being diſtended with coloured liquids, fall under the notice of our ſenſes by a tumour and change of colour in the part affected; but where the veſſels are ſo fine as not to admit of coloured liquids, either naturally, or by error of place, then, though theſe veſſels be inflamed, the place affected will not change its colour. Yet theſe veſſels when full of a diſtending liquid, though pellucid and uncoloured, may increaſe the bulk of the part, and raiſe a tumour. Οἰδήματα originally was a general name given to every kind of tumour, as has been obſerved §. 112. but the word afterwards was more particularly applied to cold watery tumours. But as in this caſe there is an heat, which is the attendant of all inflammations in the greater veſſels, ſuch a tumour is therefore called an hot œdema; but this occurs only, when there is an inflammation in the larger lymphatick arteries.

In the leſſer veſſels pains without an apparent tumour.] The ſmalleſt veſſels of the body eſcape the notice of our ſenſes, and almoſt beyond conception, as has been proved by undeniable arguments. The *punctum ſaliens* in the firſt ſtamen of a chick moves all the liquids in the veſſels, and how minute muſt theſe all be! The wonderful ſtructure of the nerves, the diſtinct actions of the brain in giving motion by the nerves, which are diſtributed to the ſeveral parts of the body, to every muſcle as the will directs, the organs of ſenſe exciting ſuch diſtinct ideas in ſo lively a manner in the mind, all theſe ſufficiently make good the point we are ſpeaking to. Should now theſe very ſmall veſſels be inflamed and ſwell, the bulk of the part will not be ſenſibly increaſed, and yet the moſt ſevere pains will follow: for even in the ſharp gout and rheumatiſm there is often no apparent tumour. For theſe diſeaſes are always of a milder nature, when the parts affected ſwell.

The pinguiferous, boney, medullary, nervous, bilious veſſels have each of them their diſtinct kind.] According to the different humours which are in the veſſels, and the fabrick of the ſeveral viſcera which they conſtitute, different diſorders will ariſe from their obſtruction. If the pinguiferous veſſels be obſtructed, the fat will ſoon corrupt by the heat and ſtagnation, and grow exceeding rancid. The veſſels of a bone, when they are inflamed, will produce a caries, exfoliation, exoſtoſis, tophi, *&c.* if the very tender veſſels in their cavities, which ſecrete the medullary oil from the blood, be inflamed, the marrow by being corrupted and cloſed up within the cavity of the bone will produce terrible diſeaſes. The nerves themſelves when inflamed will produce the ſharpeſt pains, and whilſt thus affected become entirely uſeleſs as to their office of being the inſtruments of ſenſe and motion. The bilious veſſels when obſtructed will prevent the bile, that is ſecreted by the liver from the venal blood of the abdominal viſcera, from being conveyed to its proper place, which will then fall back again into the blood, bring on a bilious cacochymy, together with the many diſorders conſequent thereupon.

## SECT. CXXIII.

WHOEVER uuderſtands what has been delivered (107 to 123) of the ſeat, nature, matter, cauſes, and effects of obſtruction, will alſo know the ſigns of an approaching or actually preſent obſtruction, as alſo its effects.

The deſign of this paragraph is to point out the diagnoſticks of a preſent obſtruction, with the prognoſticks of a future, as alſo of the effects conſequent thereupon; but theſe are all eaſy to be deduced from what has been ſaid in the foregoing chapter.

Its ſeat.] An obſtruction from an external cauſe compreſſing the veſſels may happen in any part of a canal; but if it be from any of the other cauſes mentioned, it will be generally in the narroweſt part of converging conical veſſels.

Nature.] Which appears by the definition §. 107. to conſiſt only in the exceſs of the bulk of the liquid to be tranſmitted, above the capacity of the veſſel through which it ought to paſs.

Matter.] Which is capable of being as various as there are different ſorts of fluids in the canals, or even of the ſame liquid by its different diſeaſed ſtate, may cauſe diſtinct concretions, which is another ſource of the great variety there is of obſtructions. The blood, for inſtance, may become unfit for circulation by its inflammatory tenacity, it may form itſelf into polypous concretions, or may grow viſcid by means of a cold mucous gluten, *&c.*

Cauſes.] Theſe have been enumerated already, and act either by contracting the veſſel, by increaſing the ſize of the particles of the fluid, or by error of place.

Effects.] Theſe are alſo various according to the veſſel, the matter, and the impetus of the liquid againſt the obſtructed place.

And how from theſe things known to form the proper diagnoſticks and prognoſticks, has been obſerved already §. 27.

## SECT. CXXIV.

AND knowing this diverſity, it will not be difficult to point out the cure proper to each.

As to the cure of an obſtruction, no general rule can be given, nor any thing ſaid with certainty 'till its cauſe be known. It is commonly ſaid indeed, that it is adviſeable in every obſtruction to relax the obſtructed veſſel, that ſo it may the more eaſily yield to and tranſmit the obſtructing liquid. But if the obſtruction ariſes from an error of place, of what ſervice can it always be to relax the veſſels? Certainly it was ſhewn §. 118. that the relaxation of the veſſel was juſtly reckoned one of the cauſes of this diſeaſe. Another general indication in the cure of an obſtruction, has been ſaid to be the diſſolution of the concreted obſtructing matter: but if the Phyſician knows not by the hiſtory of cauſes of what nature the concretion is, he will ſtill be at a loſs to know what he is to do. For blood concreted to an inflammatory tenacity, requires a different cure from the ſame blood grown too viſcid from a cold unactive mucus. And ſo in the reſt. The cure therefore will be various according to the variety of the cauſe, from whence the obſtruction is known to proceed.

## SECT. CXXV.

FOR that which is from external compreſſion (112) indicates the removal of the preſſing cauſe, which is to be taken from its following deſcription where it is poſſible.

In §. 112. you have all the cauſes enumerated, which have been found to form obſtructions by external compreſſion of the veſſels: for unleſs the compreſſing cauſe be known, and removed after it is known, it will be plainly impoſſible to cure the obſtruction ariſing from it; and therefore in the forecited number, theſe cauſes are divided into four claſſes, for their more regular and eaſy diſcovery.

When this cauſe is known, the next enquiry will be, whether it is poſſible to remove it or not. *V. g.* as the ampullary tumours, which from the different thickneſs of their contained matter are called atheromata, ſteatomata, melicerides, when ſituated in the external parts, where the hand may come at them, cannot without ſome difficulty be taken away, what hope is there of eradicating reſembling tumours, when ſeated in the inward parts of the body? When a pregnant womb is diſtended, and from its ſituation preſſes upon the iliac veins, as is ſometimes the caſe, an œdematous tumour falls on the legs and thighs, which cannot at preſent be removed, but will ceaſe of itſelf when the womb is diſcharged of its burden and ſunk in its dimenſions. When a confirmed ſchirrhus or a cancer, which cannot be extirpated, is the cauſe of obſtructions, what known remedy is there left to be applied? The caſe is the ſame in many other inſtances. The Phyſician, however, who can diſcover the cauſe of ſuch a diſeaſe, and ſhew that it is incurable, is no leſs ſkilful, than he that can cure a diſeaſe, which will admit of a remedy.

The cure of the other cauſes mentioned §. 112. is to be drawn either from what has been already advanced, as, for inſtance, the plethorick ſwelling; or from what will follow hereafter in diſtinct chapters concerning an inflammation, ſuppuration, ſchirrhus, *&c.* luxations, fractures, *&c.* But in caſe the compreſſion ariſes from any external application to the body, as by garments, bandages, ligatures, *&c.* the cure is plain and eaſy.

## SECT. CXXVI.

THAT which ariſes from the increaſed contraction of the fibres, is known by the ſigns whereby the too great contraction of any bowel, veſſel, or fibre is known (34, 36, 40, 50, 53); as alſo the obſtruction ariſing, when this contraction proceeds from the ſecond cauſe (113. numb. 2.) is clear by the ſigns of its cauſe; as is the other, which we have attributed to ſome preceding inanition. (*Ibid.* numb. 3.)

The ſubject of this paragraph are the ſigns, which ſhew when the cauſe of the obſtruction depends upon an increaſe of the contraction properly belonging to the veſſels. Now in §. 113. there were three diſtinct cauſes alledged, which increaſed the contraction of the veſſels. The firſt of theſe was the increaſed elaſticity of the fibres, veſſels, and viſcera. But the ſigns of an increaſed elaſticity have been already deſcribed, under the articles relating to the too great rigidity of the fibres, veſſels, and viſcera, in the places here referred to. The ſecond cauſe was the too great diſtenſion of the very ſmall veſſels, which compoſe the ſides of the greater, but this is known by the ſigns of too great fulneſs related in the hiſtory of a plethora. The third cauſe, which was more particularly attributed to a preceding inanition, is known by any great evacuations which have gone before; by the countenance ſunk, the weak ſmall pulſe, the dry tongue and mouth, and the loſs of ſtrength.

## SECT. CXXVII.

THIS ſort of obſtruction (113, 126) is to be cured 1. By the remedies that correct the too great contraction of a fibre, veſſel, or bowel (35, 36, 38, 54, 55); 2. Eſpecially by applying their virtue to the place affected, which is done chiefly by vapours, fomentations, baths, liniments; 3. By thoſe means that empty the veſſels, whereof the membranes are compoſed, when too full, to which purpoſe evacuants in general are of uſe, and eſpecially by ſuch applications to the veſſels as ſhall relax, dilute, reſolve, attenuate, deterge, evacuate; 4. By ſuch remedies as may reſolve the callus already formed.

1. Theſe have been treated of in the places referred to; and there it appeared, that art may be of great uſe in the cure of the diſeaſes, wherein the too great rigidity of the ſolid parts, has taken away the æquilibrium between the impetus of the fluids and the reſiſtance of the ſolids, which is required in a ſtate of health. But it is farther to be obſerved, that certain wonderful ſtimulants, and even the paſſions of the mind, are capable of very ſuddenly and very powerfully increaſing the contractility of the ſolids. When the vapour of kindled ſulphur is drawn with the breath into the lungs, they are immediately ſo ſtraitened in every veſſel, as to tranſmit nothing; and hence it is, that the ſmoke of ſulphur is ſo fatal to all the larger animals. Oil of vitriol, applied on a pencil to the inteſtine of a dog opened alive, makes it ſo contract as to cloſe the cavity entirely. A drop

of vinegar thrown into the eyes ſhall make the eyelids ſhut ſo cloſe, that no force can open them. Now unleſs a Phyſician knows how to remove or weaken the power of theſe ſtimulants, neither will he be able to cure the contraction cauſed by them.

How much the affections of the mind may increaſe the contractility of the veſſels, is obvious to common obſervation. If a man be ſtruck with a ſudden fright, he turns pale, and his countenance falls, the veſſels being contracted; and if we conſider, that the ſame may happen within that we ſee outwardly in the ſkin, it is plain, that moſt ſtubborn and ſtrange diſeaſes may ariſe from hence. I have ſeen a healthful woman, who upon a ſudden fright had a tumour immediately riſe in her breaſt, which, though treated as well as poſſible, hardened into an irreſoluble ſchirrhus.

2. If the whole ſyſtem of the ſolids were too rigid, the remedies proper to take it away ſhould be applied both to the whole body and to every part of it within and without. But if the ailment lie only in a particular part, why ſhould all the veſſels be relaxed? In this caſe it is ſufficient to have recourſe to a topical remedy, and to apply it only to the part affected. This is to be done chiefly by

Vapour.] Warm water of itſelf will ſoften the harder parts of the body; but if turned to vapour, will diſcharge this office much more effectually. The very hard horns of ſtags, if expoſed to the vapour of warm water will become ſo ſoft, as to be capable of being cut. I have ſeen the joint of the elbow, when grown immoveable from an obduration of the ligaments, made as flexible as ever, by being expoſed an hour in every day for two months together to the vapour of warm water. Whenever therefore this vapour can be commodiouſly directed to the part, it is to be preferred to all other methods.

Fomentations.] Which are made of watery ſubſtances, with very ſmooth herbs boiled in them, ſuch as mallows, marſh-mallows, *&c.* linſeed, oats, *&c.* Woollen cloths dipped in theſe decoctions are applied to the parts affected, and over theſe is laid a bladder ſoaked in oil to prevent exhalation, and over all hot tiles made into a proper ſhape to fit the part ſo as to keep the fomentation warm: by this means the part is kept continually in a vapour-bath. Such applications made to the ſide of a pleuritick perſon, ſhall frequently give great relief.

Baths.] Eſpecially of vapour; for a part that is under water is compreſſed by the water, but the vapour of water relaxes univerſally, as has been before obſerved. It has been found, that warm water dropping from an higher ſituation on the part affected has done wonders in ſuch topical diſeaſes. By this method I have ſometimes cured the moſt chronical and ſtubborn tumours at the knee.

Liniments.] If made of the mildeſt oily ſubſtances. The ſtiff hides of animals well rubbed with oil will become flexible. Such a ſoft oil is found in all the parts of the body which are deſigned to be flexible. All the muſcles and tendons are covered with oily ſheaths. And there is a fat unctuous liquor, which lubricates all the ligaments that connect the articulations. But this oil is every where found to be perfectly ſmooth and mild, and has no kind of acrimony in it: and therefore it would be very wrong to think, that thoſe acrid burnt oils, ſuch as the Galbaneta of Paracelſus, *&c.* are more proper for this uſe. Where too great rigidity is the only circumſtance that is amiſs in the ſolids, then the ſmootheſt oils drawn from vegetables, freſh marrow, ointment of marſh-mallows, and the like, are of ſignal ſervice; eſpecially if applied to the parts after they have been deterged by baths or fomentations, and well dried.

3. It was obſerved §. 113. numb. 2. that it appeared plainly from anatomical injections, that the ſides of the greater veſſels were made up of leſſer, which therefore by being too much filled, might make the

cavity of the greater veſſel narrower, which was compoſed of them. If the emulgent arteries, for inſtance, inflamed in their membranes, ſhould be ſo contracted in the ſmaller branches diſperſed through the ſubſtance of the kidneys, as to prevent the ſecretion of urine, it will bring on an iſchury, and this, perhaps, is ſometimes the cauſe of this diſorder, when it happens in acute diſeaſes. In hunted animals, killed after a hard chace, the coats of the greater veſſels have been found quite inflamed and turgid with blood. The cure of this diſeaſe will be obtained by

Evacuants in general.] We have nothing here but general remedies to apply, and the artificial evacuations are confined almoſt entirely to the larger veſſels. Bleeding for the moſt part is of the greateſt benefit in this caſe; for thus emptying the large veſſels, the leſſer veſſels which form their ſides are leſs compreſſed, and the force by which the liquid is impelled againſt the obſtructed place is diminiſhed; and in caſe the quantity of blood taken away be large, ſo as to endanger ſwooning, the preſſure of the vital liquid from the baſis of the veſſel to the vertex being by this means removed, the ſmaller veſſels will be enabled to contract and repel the liquid which obſtructs them in the larger veſlels. But if remedies are capable of being applied to the part affected, the methods recommended above are by all means adviſeable; thus, for inſtance, if an iſchury happen from this cauſe in an acute diſeaſe, and the patient finds in himſelf no diſpoſition to empty the bladder, it is plain, that the ſeat of the diſeaſe muſt be ſomewhere about the kidneys; then after the general evacuations premiſed, fomentations are to be applied to the loins, and clyſters injected, becauſe the colon lies very near the kidneys, and thus the remedy may be applied as near to the part affected as can be.

How laxatives, diluents, reſolvents, attenuants, and detergents act, has been already explained §. 54. numb. 4.

4. A callus, as was ſaid §. 112. numb. 1. is made by the compreſſion and concretion of the ſmaller veſſels after their liquid has been expelled; in which caſe the veſſel becomes no longer pervious, but is converted into a concreted membrane; ſo that a callus has neither moiſture nor ſenſe. The veſſels indeed as to matter remain the ſame, and only differ in their not being able to tranſmit any liquid. Yet a callus, if pared off from the ſkin, ſhall grow again, although no vital liquid flow through it. And this ſeems to ariſe from the concreted extremities of the veſſels being gradually protruded by the vital liquid; as alſo becauſe the open extremities of the veſſels that are next the callus are compreſſed by it; and thus though it be pared away, or rubbed off, it ſhall ſhew itſelf again, as we learn by daily experience. But how difficult it is to take away a calloſity, when it is once formed, will be ſeen in the following paragraph.

## SECT. CXXVIII.

BUT that kind of obſtruction, which ariſes from this cauſe, is ſeldom if ever to be cured. Emollients and laxatives are the principal remedies. Whence appears the unavoidable neceſſity of death, and the great difficulty of prolonging life by any medicines whatſoever.

I much doubt; whether ever a concreted veſſel became pervious again. For how ſhould it poſſibly be done? Would you ſeparate the concreted ſides by increaſing the motion of the vital liquid, the ſides of the veſſel next the callus, through which the liquid is to flow to it, will ſooner be broken; beſides by an increaſe of motion, the pervious veſſels when preſſed againſt the callus, will become flat and callous too, and ſo will rather increaſe the diſorder. The only hope of cure is, when the ſkin is callous, to prevent all attrition; and by degrees the outward ſurface will wear off, and the veſſels below as gradually protrude the concreted parts. The hands grown hard by labour will grow ſoft by idleneſs, and yet, perhaps, the callous place will never perſpire again from open veſſels. But if an external callus can never, or not without great difficulty, be reſolved, what remedies ſhall be uſed, or what courſe be taken, when any of the internal parts are hardened into a callus.

Emollients and laxatives are the principal remedies.] For by theſe the hard cover, that lies on the veſſels below, wherein there is life, is ſoftened ſo as to ſeparate from them, eſpecially if reſolving medicines be given in large quantities inwardly at the ſame time, in the ſpring-ſeaſon, when every part begins to grow turgid: ſome men ſuffer intolerable pain from a callus in the ſoles of their feet, ſo that they cannot walk; which ariſes from the parts underneath, wherein there is life, being oppreſſed and inflamed by the callus that lies upon them. And yet if the callus be fomented night and day with a decoction of milk and flour of linſeed, it will begin to grow ſoft, to be raiſed and ſeparated. But then the part under it appears ſmooth and poliſhed, and does not perſpire, and for this reaſon the callus grows again; to prevent which, as much as poſſible, the beſt method is to keep the place covered with ſoft waſh-leather, in order to prevent all attrition.

Whence appears the unavoidable neceſſity of death, *&c.*] It has been ſhewn §. 39. numb. 1. and §. 55. that life neceſſarily deſtroys itſelf: for to the perfection of its actions it is required, that the veſſels be duly flexible, *i. e.* ſo as to be able to yield to the diſtending fluid, and recover their former capacity again. But it was there ſhewn, that the actions of life neceſſarily ſtrengthen the ſolids by degrees, which then reſiſt the impulſe of the fluids the more; 'till at length growing quite rigid, they will not yield at all to the liquids that are propelled from the heart, and of courſe the heart cannot be evacuated; whence follows that moſt eaſy kind of death in extreme old age without any diſeaſe. If the human body be conſidered in its various ages, it will appear, that a great change is made at various times in the firmneſs of the ſolid parts. In an infant juſt born every part is ſoft, and full of liquids; the whole ſurface of the body perſpirable, the veſſels lying all open in every point; and even the very bones almoſt as flexible as wax. In proceſs of time the number of pervious veſſels diminiſhes; the ſtrength and firmneſs of every part is increaſed; the bones grow hard; and at length in old age the whole body is dried up; the joints which were ſo flexible in youth become ſtiff; there is no fat to be ſeen; the ſkin grows flabby, callous, and ſo deformed with wrinkles, that it is ſcarce perſpirable; the bones become very brittle; the cartilages aſſume a boney nature; and the veſſels, which before were membranous and flexible, put on the nature of cartilages, and even of bones. And the more the efficacy of the vital actions has been increaſed by the animal actions, the ſooner this rigidity comes on; and for this reaſon ſuch animals as have been accuſtomed to too much exerciſe grow old before their time.

Let thoſe then, who boaſt that they can put off the fatal period of life, try their ſkill to prevent or cure the ſtiffneſs attending upon old age. Such boaſters there have always been, who have dared to promiſe to mortals an ἀγηρασία, and even immortality itſelf; and many have believed what all ſo greedily deſire. In Galen's time a philoſopher wrote a book to ſhew how a man might live without growing old. This he wrote in his fortieth year; and lived after 'till fourſcore, but ſo lean and withered, that he became a general jeſt; and when his own example ſhewed the falſeneſs of his doctrine, his evaſion was, that it was not every man that was capable of this attainment, but only ſuch as had a proper conſtitution; and that he would make the bodies of infants, proper for immortality, if he might have the care of them from the beginning. This he might ſafely boaſt indeed, as he himſelf was ſure to die before ever they could come to age (*a*).

But as he placed his hopes of doing this in a proper diet, he was leſs raving than the chemiſts, who have pretended by giving a few drops every day to lengthen out life to a thouſand years, and then they would deliberate whether it were beſt to live any longer. Paracelſus himſelf dying in his forty-eighth year, ſhewed how little regard was due to ſuch vain boaſting.

If any thing could contribute to prolong life, it would be ſuch a remedy as would prevent too great rigidity: for this reaſon Galen recommends a moiſtening diet to old men (*b*), and in another place (*c*) treats of the ſame ſubject more largely.

## SECT. CXXIX.

THAT unfitneſs of the fluids to paſs through the veſſels, which depends on the loſs of their ſpherical figure, is to be known from the cauſes obſerved (116), as they are generally diſcoverable by the ſenſes.

It was ſhewn §. 115. that a ſphere is the only figure that can paſs a given orifice in every ſituation; provided the diameter of the tranſmitting orifice be ſtill greater than the diameter of the ſphere. For all the ſections of a ſphere made by a plane paſſing through its center, and parallel to any given plane, are equal figures, and of a ſimilar poſition, being all of them equal circles. As ſoon therefore as the elementary particles of the fluids, which ought to paſs ſingle

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(*a*) Galen. de maraſmo, cap. 2. Charter. Tom. VII. p. 179, 181.
(*b*) De ſanitat. tuenda, Lib. V. cap. 5. Charter. Tom. VI. p. 152.
(*c*) De maraſmo, cap. 5. Charter. Tom. XII. pag. 183.

ſingle through the extremities of the veſſels, have loſt this figure, there may ariſe an innumerable variety of poſitions, which ſhall prevent their paſſage. But how ſhall we be able to know, when the obſtruction ariſes from this cauſe. It is certain the figure of theſe particles cannot be diſcovered in the pellucid parts of living animals, but by the help of a microſcope. It will not therefore be an eaſy matter by the ſenſes to make this diſcovery in the obſtructed part of an human body. But the cauſes deſcribed in §. 116. by which the uniform compreſſion of the particles of the fluid is taken away, are eaſily known; and therefore when we know that theſe cauſes have preceded, we need not ſcruple to aſcribe the obſtruction that is formed to the loſs of a ſpherical figure in the particles of the fluid.

Theſe cauſes were three, a too languid motion of the fluid through the veſſels, and this is known by the pulſe; a too great laxity of the veſſels, and this is known by what has been ſaid in §. 27. and 44. and the quantity of the liquid diminiſhed, which is known by large evacuations having preceded, by the veſſels being collapſed, and by the drineſs of the whole body.

## SECT. CXXX.

IT is to be cured by ſuch remedies as reſtore that figure to the particles of the fluid; of which ſort are, whatever increaſe their motion through the veſſels and viſcera, and ſuch are all ſtimulant and ſtrengthening medicines, as alſo every quick animal motion.

The human body if in health has the power, out of very different animals, of making blood, which ſhall conſiſt of particles that have a ſpherical figure; though this figure did not before pre-exiſt in the particles of the aliments, but was derived from the action of the veſſels and viſcera, by which the aliments are converted into our nature. If this figure then be wanting in the elementary particles of the fluids, all that art can do is to reſtore thoſe cauſes by which this figure is naturally given to the elementary particles.

Now the motion of the humours through flexible veſſels, and their ſtrong re-action on the humours which diſtend them, is the cauſe which produces this change of figure in the crude aliments. The chyle by flowing with the blood through the veſſels, in twelve hours is turned into blood; and this change is ſo much the quicker and more perfect, as the action of the veſſels upon the fluid, *cæteris paribus*, is ſtronger: and for this reaſon the aſſimilation is ſpeedy in ſtrong laborious men, more ſlow in ſuch as are weak and languid.

The loſt ſpherical figure of the particles of the fluids therefore, it is plain, is to be reſtored by increaſing the ſtrength of the veſſels, wherewith they preſs the fluids they contain, and by cauſing their action to be exerted on the fluids more frequently in the ſame time, *i. e.* by increaſing the velocity of the circulation.

How the ſtrength of the veſſels is to be increaſed, has been obſerved §. 28. and 47. How the velocity of the circulation, §. 28. numb. 2. And how ſtimulants produce this effect, §. 75. numb. 5.

In the cure of lax cold bodies that are full of mucous humours, Phyſicians ſtudy to revive the languid motion by the moſt grateful aromatick ſtimulants, and eſpecially by ſteel diſſolved in mild vegetable acids. They increaſe the velocity and power of the circulation by friction, riding, and other exerciſes. Hereby the agteeable florid colour ſoon returns, the ſureſt ſign that red blood is again generated, and all the functions which before were languid and depraved, are again reſtored. Whence it plainly appears, that there is then a free circulation through all the veſſels, and that the elementary particles have therefore again acquired the ſpherical ſhape, which was requiſite to make them paſs through the extremities of the veſſels in any poſition.

Animal motion increaſed has a double efficacy in this caſe, by increaſing the velocity of the circulation, and by making the ſolid parts more firm; as was obſerved §. 28. numb. 2.

## SECT. CXXXI.

AS the inſpiſſation and concretion of the liquid maſs may ariſe from ſo many and ſuch different cauſes (117), it will alſo require various remedies according to their nature, as alſo a different method of cure: which difference as to each diſeaſe being underſtood, will ſuggeſt the proper means and method of applying them.

The cauſes aſſigned for obſtructions, ſo far as concerned the fluids, were two. The change of figure in the elementary particles, and the union of ſuch as were before ſeparate, by both which they were rendered unpaſſable. This union depends on all various cauſes excited §. 117. many of which are juſt the oppoſites of each other, ſuch as reſt and motion, heat and cold; as nothing certain can be determined concerning the cure, unleſs the particular cauſe be firſt known, from whence the concretion aroſe. Abſolute reſt and an increaſe of motion, cold and heat, will all cauſe a concretion of our fluids: but cauſes ſo oppoſite will alſo require a different method of cure. When the humours become unable to paſs in languid chronical diſeaſes, the velocity of the circulation is to be increaſed by ſtimulants in order to divide the concreted matter. When an inflammatory viſcidity thickens the blood in acute diſeaſes, the vital power is to be weakened by bleeding, to make the blood move ſlower. When the veſſels are too weak, and do not act powerfully enough upon their contained fluids, concretions will ariſe in the liquids from their ſtagnation or want of due motion. When the veſſels are too ſtrong, and too much compreſs the fluids they contain, the thinneſt part of the fluids is expreſſed, and the reſt becomes more compact, viſcid, and ſo gives riſe to concretions.

In all diſeaſes therefore, that ſpring from obſtructions in the liquids, the nature of the cauſe is to be inquired into, before any thing can be determined about it. The following paragraph contains only the general method of removing concretions of the fluids.

## SECT. CXXXII.

BUT in general the concretion of the liquid maſs is removed, 1. By the reciprocal motion of the veſſel; 2. By dilution; 3. By the introduction, mixture, and united motion of an attenuant fluid; 4. By removing the coagulating cauſe.

1. Every time the heart expels its blood, the arteries are dilated, and contracted again when the action of the heart ceaſes; ſo that the liquid impelled overcomes the reſiſtance of the veſſels, and is overcome by it alternately; and the liquids are every moment rubbed againſt the ſides of the veſſels, eſpecially in their very narrow extremities, where the elementary particles either paſs ſingle, or at leaſt but few of them together. This attrition of the fluid by the reciprocal motion of the veſſels, both prevents their concretion, and is alſo the beſt remedy to take it away when formed. The blood, as ſoon as it is let out of the veſſels, preſently coagulates, which this perpetual attrition prevents while it is in them. And as obſtructions are chiefly in the extremities of the arteries,

ries, as has been ſhewn §. 119. and the reciprocal motion in the arteries laſts ſo long as there is life; ſo the united maſſes of blood, which are ſtopped in the extremities of the arteries, may be again in all appearance divided and reſolved by this mechanical attrition. For the blood let out of a veſſel, and coagulated, may be again made fluid by attrition only; for by nothing elſe but rubbing the red concreted part in a glaſs-mortar, I have been able to work it up into a frothy florid liquid.

We have a curious obſervation in Leewenhoeck (*a*), which plainly ſhews the efficacy of this reciprocal motion of the veſſels in diſſolving concreted blood. Having found a bat that was almoſt ſtarved with hunger and cold, he examined with his microſcopes the fine membrane which ſerves that animal inſtead of wings, but ſaw no motion either in artery or vein. Six hours after, the animal being ſomewhat more revived, he obſerved an oblong particle of concreted blood, which filled the whole cavity of an artery, to be protruded through it, and immediately driven back again; ſoon after it was protruded again, and thus continued moving backward and forward, 'till at length by this attrition the maſs was reſolved, and paſſed through the extremities of the artery into the vein. We could not wiſh for a clearer inſtance of an obſtruction ariſing from the conjunction of the particles of the fluid; and at the ſame time we plainly ſee, how by the vital motion of the fluids through the veſſels, and their attrition againſt the ſides of the veſſels, this concreted maſs is again divided, and the obſtruction reſolved.

2. By dilution.] When a thinner liquid inſinuates itſelf between the concreted particles, and ſo removes them from their contacts with each other, the obſtruction is ſaid to be reſolved by dilution. Thus if in the laſt mentioned inſtance, whilſt the concreted maſs was moving backwards and forwards in the ob-

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(*a*) Experiment. & contemplat. pag. 205, &c.

ſtructed veſſel, a thin liquid could have been poured to it, and rubbed along with it againſt the ſides of the veſſels, it would have reſolved the concretion ſooner. Beſides diluents are of a watery nature, they always make the ſolid parts of our bodies more lax, and ſo more diſpoſed to tranſmit the obſtructing maſs. Yet as diluents alone will not always diſſolve concretions, we are often obliged to have recourſe to other means. And therefore,

3. If ſuch ingredients be mixed with the diluting liquid, as are known to have a power of diſſolving a concreted maſs into its original parts, this will be the utmoſt that can be expected from art. Now whatever of this kind we take down is received by the veins, and carried to the obſtructed place by the power of the heart and arteries; and if the maſs be yet moveable, ſo as to be able to paſs and repaſs with a reciprocal motion, is continually ſliding by it, rubbed againſt it, moved, and mixed with it, 'till it is at length reſolved. But if the obſtructing maſs ſtick faſt and remain immoveable in the extremities of the veſſels, then the attenuant liquid can only preſs upon it from behind, but cannot be moved or mixed with it, and in this caſe the concretion is very difficult to be reſolved. This ſeems to be the unhappy circumſtance, when the beſt diluents and attenuants given inwardly in great quantities prove ineffectual, and are not able to diſſolve the blood when concreted by an inflammatory viſcoſity.

4. By removing the coagulating cauſe.] If this can be done, but for the moſt part this is very difficult. If for inſtance the blood be coagulated by acids, there are bodies which are known to attract them; but if the coagulated blood ſtick faſt in the extremities of the veſſels, and be cloſely ſurrounded by the ſides of the obſtructed veſſel, it will not be eaſy to come at the obſtructing coagulum. Beſides, thoſe very ſtrong acids do not only coagulate by interpoſing themſelves between the parts of the blood that did not cohere

before, but in a moment, and as it were by the meer touch, cauſe the maſſes, which before were ſeparate, to cohere together; ſo that though you mix an alcali, which ſhall immediately attract the acid, with blood that has been coagulated by an acid, yet the blood will not return to its former ſtate of fluidity. If the coagulation ariſe from ſpirituous fermented liquids, it will be equally or rather more difficult to conquer it, becauſe the coagulation will remain, though the ſpirituous ſubſtance be expelled. For if ſerum be coagulated by alcohol, it will not diſſolve, though the coagulating cauſe be expelled by heat that is ſo mild as not to make the ſerum run into concretion. But if the blood be coagulated by froſt, we can extract the icy ſpicula by a prudent application of very cold water; but in what manner, and with what caution this is to be done, will be explained hereafter in §. 454.

## SECT. CXXXIII.

Reciprocal motion is given to the veſſels, 1. By whatever moderates the diſtending cauſes, as bleeding; 2. By whatever ſtrengthens the veſſels (28, 29, 45, 46, 47, 49); 3. By friction and muſcular motion; 4. By ſtimulants.

1. The cauſes that diſtend the arteries are the blood with which they are filled, and the force of the heart propelling more blood into them when they are already full. Now to continue the ſyſtole and diaſtole in the arteries, the diſtending cauſes muſt not be intirely taken away, for if the artery be not diſtended, neither will it be contracted afterwards. But theſe cauſes ſhould be ſo moderated, as that they may in their turn give way to the cauſes which produce the ſyſtole of the arteries; for which reaſon it is here rightly ſaid, that the diſtending cauſes ought to be moderated. For if when the arteries are diſtended, they could

not empty themſelves into the veins, either becauſe the veins were already too full, or the extremities of the arteries were obſtructed, then the heart would ſtill go on to diſtend them, but they would not be able to contract themſelves again, and ſo the reciprocal motion would ceaſe. For every veſſel that is too much diſtended, if it remains thus full, is a dead veſſel. And if this were to be the caſe in all the veſſels, death would inſtantly follow; and whatever thus happens in ſome of the veſſels, there is no longer any circulation in them, but the liquid ſtagnates in them and remains unmoved.

There is then left only one remedy to take away this plenitude, and that is to open a vein, in caſe the veins are too full to admit any liquid from the arteries. But if the obſtruction lies in the extremities of the arteries, and the blood is by this means accumulated in the arteries, the ſection of an artery then becomes much more adviſeable; for as the free paſſage of the blood from the arteries into the veins is hereby interrupted, the opening of a vein cannot take away the too great fulneſs of the arteries. For which reaſon in acute diſeaſes the burſting of a little artery in the noſtrils, is often ſeen to relieve this plenitude by the ſalutary aſſiſtance of nature. And therefore it was, that Hippocrates ſo carefully enumerates the ſigns which point out to us when nature attempts to relieve this way, leſt we imprudently diſturb or prevent this ſalutary evacuation.

But beſides, bleeding leſſens the powers by which the heart propels the blood into the arteries; for by bleeding, life may be diminiſhed even to ſwooning and death. From whence it is plain, that by this means the diſtending cauſes are leſſened moſt effectually.

We ſee this very clearly in very plethorick people, in whom the circulation is apt to be ſtopped, as the veſſels are too much diſtended to be able to contract themſelves, the pulſe alſo begins to grow languid, and they at laſt become ſtiff like ſtatues. But as ſoon as this fulneſs is abated by bleeding, the veſſels contract again and propel the diſtending humours, and then the powers revive, which before were in a manner lifeleſs.

The great efficacy of theſe evacuations to diſſolve obſtructions, is viſible from obſervation. A perſon labouring under a very ſharp pleuriſy, to avoid the ſeverity of the pain, ſhall forber to breathe, and be ſuffocated by the omiſſion. And yet bleeding ſhall often give relief in an inſtant, and ſometimes even abſolutely take away all the pain, the ſmall veſſels contracting and repelling the obſtructing particles into veſſels that are large. Galen, when a young man, being admoniſhed in a dream, cut aſunder the artery in his own right hand, that runs between the fore-finger and the thumb; he let it bleed, 'till it ſtopped of itſelf, for ſo the dream directed; and by this means was cured of a fixed pain in that part where the liver joins to the diaphragm. Another perſon had the artery in the ankle wounded, which bled on 'till Galen came and cut through it, but hereby he was cured of a pain in the hip, which had been troubleſome to him for near four years (*a*).

2. The reciprocal motion of the alternately contracted and diſtended artery, aroſe partly from the force by which the heart impels the blood, and partly from the elaſticity and muſcular force of the artery, by which it is able to contract itſelf. But it was ſhewn §. 26. that the weakneſs of the fibres cauſes an extenſion of the veſſels that are made up of them, and leſſens the force of their action on the fluids they contain; when this therefore is the cauſe why the veſſels contract with too little power, there the indication is to ſtrengthen the veſſels.

But too much diſtenſion of the veſſels itſelf is frequently the cauſe of this weakneſs. Thus if the blad-

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(*a*) Galen. de curand. ratione per venæ ſection. cap. 23. Charter. Tom. X. pag. 451.

der be diſtended with urine too long, it becomes well nigh paralytick, and loſes all its power of contraction; and on this cauſe perhaps many appearances in diſeaſes depend. A violent ophthalmy often leaves the veſſels ſo lax ever after, as to be diſtended and grow red by every the ſlighteſt cauſe: in theſe caſes ſtrengtheners prudently applied are the only remedies. Acute inflammatory diſeaſes of the head often leave the functions of the brain diſordered, though the fury of the diſeaſe may have been long abated, the pulpous veſſels of the critical ſubſtance of the brain remaining ſtill obſtructed: by gradually diſſolving the obſtructing matter, and increaſing the ſtrength of the veſſels, this diſorder may be overcome. But if the Phyſician perſiſt in the debilitating method of cure, it ſhall leave them ever after incurable ideots.

The manner and means by which the veſſels are to be ſtrengthened, are to be found in the places cited.

3. Frictions cauſe a ſucceſſive and repeated compreſſion and relaxation of the veſſels, and ſo ſupply the place of their reciprocal motion. By preſſing the liquid from the apex of the veſſels to the baſis, we may turn the arteries into veins, and ſo bring the obſtructing matter out of the narrow into broader parts of the arteries, into which it preſently returns again when the veſſel is relaxed. If this be often repeated, it will be exactly the ſame caſe as Leeuwenhoeck ſaw in the bat; *i. e.* the obſtructing matter will be divided and attenuated by going backwards and forwards, 'till at laſt it can paſs into the veins.

Obſervation ſhews the great uſe of frictions in reſolving obſtructions. I have ſeen an indurated parotid gland, after many very good applications have failed, reſolved by being well rubbed with woollen cloths for an hour together twice a day, after having been expoſed to the vapour of warm water and vinegar. The like alſo has been ſeen in the glands of the neck, when they have been ſtrumous.

Muſcular motion alſo is of ſingular uſe in this caſe, as the motion of the venal blood being accelerated thereby, it occaſions the heart to contract oftener and ſtronger, increaſes the circulation, and more frequently diſtends and contracts the veſſels alternately in a given time.

4. It is certain from obſervation, that there are ſuch medicines, as if given inwardly, and applied outwardly to the body, ſhall increaſe the motion of the humours in whole or in part; theſe we call ſtimulants. Theſe when mixed with the vital fluid, that is moved through the veſſels, ſeem either by their bulk and figure (which are ſo contrived as to communicate the violence of their motion in very few points to the parts whereto they are applied) to irritate the ſides of the veſſels into more frequent and ſtrong contractions; and their action may be explained by the rules of mechaniſm: or elſe they are ſuch, as having no manner of acrimony diſcoverable by the ſenſes, are yet found by their certain effects (though we do not know the manner of their operation) to have the power of increaſing the motion of the fluids through the veſſels, and the attrition of the veſſels againſt the fluids. But of theſe we have already treated in §. 75. numb. 5. and in §. 99. numb. 2.

## SECT. CXXXIV.

WATER dilutes, eſpecially if warm, whether given in drink, injected, received in ſteams, or outwardly applied; and then propelled to the place where the matter to be diſſolved adheres: to this head belong derivation, attraction, and propulſion.

The only diluent with reſpect to our liquids, if you except the fat parts, is water; and whatever elſe is called a diluent is ſo only upon account of the water it contains,

contains. To dilute, properly ſpeaking, is to ſeparate the particles that are united, by mixing and interpoſing watery particles between them. But to this there is required a certain degree of heat: for cold water rather coagulates the liquids and conſtringes the veſſels, and upon both accounts is prejudicial in this caſe. Hot water makes the blood run into concretion in a moment. The beſt degree of heat is that which but a little exceeds the warmth of a ſound body. This is to be applied to the part affected, either by vapour, fomentation, or cataplaſm, *&c.* or to be drank, or given in clyſters, or reſorbed by the veins which lie on the internal or external ſurface of the body: it either way ſoon mixes with the blood, and is then diſtributed equally through all the body. But the indication chiefly requires, that the diluent water ſhould be applied to the parts obſtructed, rather than to any other part.

Now we are ſupplied by art with ſuch remedies, as are capable of increaſing the impetus and quantity of the vital liquid in any part of the body. And theſe are ſuch, as leſſen the reſiſtance in the part, towards which the caſe requires that the humours ſhould flow in greater plenty, and with a greater force. But whatever part of the body the liquid is to be driven into, it will be reſiſted by the fulneſs and ſtrength of the veſſels. Whatever therefore will render the veſſels more empty, or take off from their lateral reſiſtance, will cauſe the humours to flow to that part in greater quantity and with greater motion. Fomentations, cataplaſms, and the vapour of warm water, will do this effectually, by relaxing the ſides of the veſſels; cupping-glaſſes alſo by taking off the preſſure of the atmoſphere from the part, to which they are applied, will make the reſiſtance leſs: and frictions, by emptying the veins, will likewiſe cauſe the arteries alſo to diſcharge the liquid they contain the ſooner into them; for this reaſon they increaſe the velocity of the circulation in the part, and by this increaſe of celerity cauſe a larger quantity of humours to flow through the ſaid part in the ſame given time; and if the parts be ſcarified, upon which the cupping-glaſſes are placed, the reſiſtance will be ſtill rather leſſened by the depletion of the veſſels. Farther, whatever when applied to the body ſhall ſtimulate the veſſels into quicker concretions, for the ſame reaſon ſhall produce the like effect; which is the reaſon why ſinapiſms, bliſters, *&c.* are ſo very ſerviceable in this caſe.

Experience clearly ſhews us, how very uſeful theſe applications are. If any part of the body be expoſed to the vapour of warm water, it will ſoon ſwell and grow red, by the greater quantity of liquids derived to it. When in a phrenſy all the functions of the brain are diſordered, what great relief is often obtained from baths, bliſters, and cupping-glaſſes applied to the lower parts! A pleuriſy is never more happily cured than it ſometimes is by keeping the ſide affected continually ſupplied with emollient fomentations, and wrapping it up warm night and day. The moſt diſſolving remedies applied to ſtrumous glands in the neck avail but little, unleſs fomentations be applied too.

Such applications therefore as have power to make the veſſels, that belong to the place where the obſtruction is fixed, to be more ſpeedily emptied, and more eaſily filled, are called *derivatives* and *attractives*, as by their means the water applied to the body, received into the veins, and mixed with the blood, is conveyed to the part affected in a greater quantity in a given time.

Propellants are ſuch remedies as increaſe the motion of the humours through the veſſels; for by this increaſe, the water alſo that is mixed with the blood is carried along with the greater celerity. Theſe however act in an uniform manner upon the whole body; but ſuch medicines as attract and derive, determine the effect of the increaſed motion only to the obſtructed part.

When theſe particulars all conſpire together, ſuch diſeaſes are often cured, as have been judged by many to be deſperate. In the *ſpina ventoſa,* and the venereal diſorders of the bones, which are apt to elude even the moſt efficacious remedies, it is uſual to give large draughts of the decoction of Guaiacum wood, and when the body has imbibed as much as it can well contain, to excite a greater motion, and even raiſe a fever, by applying the fumes of burnt brandy to the naked body incloſed within a blanket, by which means the decoction of the Guaiacum is propelled more ſwiftly through all the veſſels. In the mean time the part affected is either wrapt up in flannels, which have imbibed very emollient fomentations, or ſo placed as to receive directly the vapour of the burning ſpirit. And thus the efficacy of the remedy will be derived and attracted to the part affected, and frequently work a cure.

## SECT. CXXXV.

ATenuants are, 1. Water; 2. Sea-ſalt, ſal gem, ſal ammoniac, nitre, borax, fixed alcaline ſalt, and volatile ſalt; 3. Soaps made of alcalies and oil, whether native, compoſite, fuliginous, volatile, or fixed, as alſo the bile; 4. The mercurial preparations, which are to be conveyed to the proper part by ſuch remedies as have the power to derive, attract, or propel.

1. Water holds the chief place among attenuants. The chemiſts have advanced, that all things have grown from water changed by the ſeminal principle of things, and in the laſt effect of art and nature might be reſolved into water again. And for this reaſon they have allowed it an almoſt univerſal power of reſolving. For the elementary particles of water have this property, that, when ſeparated from each

other by heat, (for water concreted into ice has not the leaſt diſſolving power) they can receive in between their interſtices the particles of the bodies that are diſſolving them, and ſo perfectly ſuſtain them, as to carry them along with them through all places, whither they themſelves are capable of penetrating, unleſs they happen in their paſſage to meet with any other bodies that attract them more ſtrongly, than the water they are diſſolved in does, for then the water muſt let them go; *v. g.* a grain of ſea-ſalt diſſolved in water ſo as to diſappear entirely, and though it be diluted with ten pints of water, yet every ſingle drop of water will have its proportional quantity of the ſalt, which thus diſſolved will penetrate through all the veſſels where the water itſelf could. But it appears from experiments, that the fineſt fluids of the body that are diſcernible by the ſenſes, conſiſt of water, or at leaſt the greateſt part of them. Freſh urine emits a ſteam, which if it be collected in clean veſſels appears to be water with ſomething ſpirituous in it, which ſends forth a ſmell. The like vapour exhales from blood juſt emitted. That very fine fluid that perſpires from the ſurface of the whole body, if any one will be at the pains of collecting it, is found to be water, but with ſome other very ſubtle part lurking in it, that can only be diſtinguiſhed by the ſmell, which, whether it be water or ſomething elſe, does not yet appear. It is plain however, that water may paſs through the perſpiring veſſels, whereof upwards of an hundred thouſand lie within the ſame compaſs as a grain of ſand, according to the calculation of Leewenhoeck. If therefore an obſtructing particle is capable of being attenuated and diſſolved by water, it will paſs with the water through the ſmalleſt veſſels, and ſo the obſtruction will be reſolved.

Hence it is, that when but a moderate quantity of the water is drawn off, our humours become oftentimes unpaſſable, and are attenuated again, when that is reſtored : *v. g.* the exhaling arteries depoſite a moſt ſubtle liquid in the cavities of the noſtrils, which turns to a tenacious mucus, when the moſt moveable aqueous part is carried off, and yet this mucus may again be attenuated by water and diſſolved.

But this attenuating power of water, is not capable of diſſolving every concretion that is found in the human body. It attenuates indeed and diſſolves all ſaline, mucous, mucilaginous, gelatinous, cold, pituitous, and ſoapy concretions ; but the inflammatory ſpiſſitude of the blood, all oleous, ſebaceous, calculous concretions, *&c.* are incapable of being diſſolved by water ; however there are other means to diſſolve theſe, though water alone cannot do it, ſuch as ſalts, ſoaps, *&c.* but then theſe alſo require water for their vehicle to convey them to the obſtructed place. Water therefore is of almoſt univerſal uſe in opening obſtructions, whether it acts as an attenuant, or as a vehicle to tranſmit other ſolvents to the place obſtructed.

2. Sea-ſalt, ſal gem, ſal ammoniac.] Theſe ſalts, being much alike in many of their qualities, have alſo a reſembling power of attenuating. The two former when given inwardly mix indeed with our humours, but paſs off by urine in a great meaſure unchanged ; for which reaſon, though they paſs through moſt of the veſſels of the body, yet they undergo no alteration from their action. Now whatever is taken down, and cannot be changed by the powers of the body, will conſtantly excite a greater motion, and thus will act alſo as ſtimulatives.

But ſal ammoniac, which is lighter than the other two, and more like the native ſalts of the blood, is more capable of being changed by the powers of the body, and of a very penetrating nature, and is therefore generally preferred before the reſt, and juſtly commended as one of the greateſt deobſtruents both in acute and chronical diſeaſes.

The action of theſe ſalts ſeems to conſiſt in this, that when they are mixed with the humours diſſolved, and conveyed to the obſtructed place, from a kind of conſtant attrition by the action of the veſſel againſt the obſtructing maſs, they divide it by their weight and figure, and thereby make it paſſable through the veſſels; at the ſame time increaſing the action of the veſſels by their ſtimulating property.

And how great their efficacy is, appears plainly from obſervation. When the veſſels under the unbroken ſkin are corrupted by a contuſion, and the blood concreted into a maſs, which is ſtill entire, theſe ſalts diſſolved in water and applied to the part, ſhall moſt happily diſſolve it. Thoſe, who indulge themſelves too much in eating large quantities of ſea-ſalt, ſhall have their blood ſo diſſolved, that it can ſcarce be retained in its veſſels; and hence ſhall oftentimes ariſe very violent hæmorrhages, partly from the blood's being too much diſſolved, and partly from the too great acrimony of the humours which erodes the veſſels.

Nitre.] The modern nitre ſeems quite different from that of the antient; for there it ſeems to have been of an alcaline nature, or perhaps it was the ſal ammoniac to which they give this name. Pliny (*a*) ſays, *nitrum in picatis vaſis adferri, ne liqueſceret; calce reſperſum reddere odorem vehementem; in teſta operta exuri, ne exultet*; "that nitre was brought in veſſels "that were well pitched over that it might not melt; "that if it was ſprinkled over with lime it emitted "a very ſtrong ſmell; and that it was burnt in an "open veſſel that it might not fly." By theſe qualities it agrees very well with ſal ammoniac, but not at all with the modern nitre. In another place (*b*), where he is ſpeaking of the invention of glaſs, he ſays, *famam ferri, quod appulſa nave mercatorum nitri, cum ſparſi per littus epulas pararent, nec eſſet cortinis atollendis lapidum occaſio, glebas nitri de nave ſubdidiſſe, quibus accenſis permiſta arena littoris, tranſlucentes nobilis*

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(*a*) Lib. XXXI. cap. 10. (*b*) Lib. XXXVI. cap. 26.

*lis liquoris fluxiſſe rivos, & hanc fuiſſe originem vitri*; "it is reported, that the ſeamen of a ſhip loaden "with nitre coming aſhore to dreſs their victuals, "for want of ſtones to raiſe their kettles on, took "lumps of nitre out of the ſhip, which kindling and "mixing with the ſand made tranſparent ſtreams of a "noble liquor, and that this was the original of glaſs." This ſtory ſhews the antient nitre to have been of an alcaline nature; which induced Mr. Boyle and ſome others to conclude, that the Ægyptian *ſoda* was the nitre of the Antients.

But the nitre of the Moderns ſeem to have been unknown to the Antients, and of a nature ſtrangely ambiguous between vegetable, animal, and foſſile: it is found in deſert uninhabited parts of the Eaſt Indies, lying in a very thin cruſt upon the ſurface of the earth, eſpecially after great rains; in other parts it is got by boiling a black ſort of earth: it is found in old buildings, church-yards, ſtables, dove-houſes: and ſome plants have an eſſential ſalt, which is collected by inſpiſſation only of the expreſſed depurated juice, and is in every property exactly like nitre.

This nitre, if free from all ſea-ſalt, remains dry in the air, diſſolves entirely in water, is the lighteſt almoſt of all ſalts, is a very great attenuant, can be changed by the powers of the body, is cooling, and of the greateſt ſervice in acute diſeaſes, where there are obſtructions from an inflammatory denſity in the blood. It is preferable to ſea-ſalt or ſal gem, becauſe it is lighter and can be ſubdued by the body; to ſal ammoniac, becauſe that is in great meaſure made up of a volatile alcali, which is very prejudicial in theſe diſeaſes; eſpecially as it poſſibly may be ſet free from its connecting acid of ſea-ſalt, when it meets with putrified or alcaline humours.

Borax.] This is a very wonderful ſalt, whoſe nature is not well known, and its hiſtory confuſed even in the beſt writers. Some reckon it to be the chryſocolla of the Antients: but Dioſcorides (*c*) commends in the chryſocolla, a bright green reſembling the colour of a leek, and at the end of the ſame chapter tells us, that it will excite vomiting, and ſometimes prove mortal: and elſewhere (*d*), that a glue is made of urine and Cyprian braſs fit for to ſolder gold (ἁρμόζουσα ἐπὶ τοῦ χρυσοῦ κόλλα) So Pliny (*e*) commends the colour of chryſocolla when it is like green corn: and ſays, that in Nero's ſhews the ſand of the Circus was ſtrewed with chryſocolla. He alſo obſerves, that it excites vomiting, and that the goldſmiths uſe it for ſoldering gold; and then adds, that in this caſe it is mixed up with a compoſition made of Cyprian braſs, the urine of a youth under age of puberty, and nitre.

So that by its colour and effects the chryſocolla of the Antients ſeems to have had in it a mixture of copper; whereas it appears from the tranſactions of the Royal Academy of Sciences (*f*), that ſome of the greateſt chemiſts, when inveſtigating its properties, could find no copper in borax; but that it is of a nature ſomewhat alcaline, and has great affinity with the *ſoda* of the Ægyptians; only it is leſs alcaline, and has beſides in it an earth that will turn to glaſs, and a neutral ſalt that as yet is not well known.

It is commended much as a deobſtruent, and uſed in the moſt obſtinate diſeaſes; as it acts partly by its wonderful ſtimulus, and partly by its attenuant ſaline power.

Fixed alcaline.] This is the offspring of art only, and not of nature, ſo called from the herb kali, which when it is burnt in an open fire leaves aſhes behind abounding very much with ſalt. This ſalt is obtained from various ſorts of vegetables, but without any difference, except only in greater or leſs degree of acrimony. It is chiefly uſed where cold, ſluggiſh, and viſcid pituita prevail; but where heat, pu-

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(*c*) Lib. V. cap. 104. (*d*) Lib. II. cap. 99. (*e*) Lib. XXIII. cap. 5. (*f*) L'an 1728, 1729, 1732, &c.

trefaction, or great drineſs predominate, it is never ſafe to uſe it.

Volatile.] All animals and vegetables that have hitherto been brought to the trial, yield a volatile alcaline ſalt when putrified. All animals yield this ſalt by ſimple diſtillation. The humours of animals that are not alcaline, if mixed with a fixed alcaline ſalt, will yield a volatile alcaline ſalt. Some very acrid plants, ſuch as muſtard, ſcurvy-graſs, water-creſſes, onions, *&c.* contain this ſalt, which ſhews itſelf by the ſmell as ſoon as the plant is broken, and is eaſily obtained by diſtillation. And the volatile alcaline ſalt, obtained from all theſe ſeveral ſubſtances, when purified according to art, appears to be in every reſpect one and the ſame.

Theſe ſalts have very near the ſame uſe as the fixed alcaline; but being very volatile, are diſſipated with the leaſt degree of heat and fly off; for which reaſon they have not ſo durable an effect; but if they are confined cloſe to any part where their action is wanted, they deſtroy all before them. Thus if a volatile alcaline ſalt be applied to the ſkin, and covered with ſome ſticking plaſter, it will burn it, 'till it bring on a gangrenous incruſtation; for which reaſon there need of great caution in the uſe of them.

3. All ſoaps contain an oil ſo accurately mixed with a ſalt, as to be capable of being diſſolved in water without ſeparation; for this is required, before they can be called ſoap. Many of the ſoaps are native, *v. g.* honey, which in the chemical examination, as well as by its excellent uſes in many chronical, but more eſpecially in acute diſeaſes, ſhews itſelf to be of a very diſſolving ſoapy virtue. Sugar alſo, ſo much uſed of later ages, though not unknown probably to the Antients, which burns in the fire, is diſſolved in water, and may be reduced to cryſtals, has the like virtue. The freſh or inſpiſſated juices of the ſummer fruits well ripened, have an incredible power to liquify and diſſolve whatever they are mixed with.

The juices of freſh-gathered herbs have their oils and ſalts ſo well united as to deſerve to be called ſoaps; nay ſome of them have the virtue of cleanſing foul cloths like ſoap, as, for inſtance, the juice of ſoapwort.

If the oil of vegetables or animals be united in a certain manner with acrid fixed alcaline ſalt, it becomes a ſoap, which has the former detergent and diſſolvent quality of the ſalt, *i. e.* the power to diſſolve all oleous, fat, reſinous, pituitous, amurcous ſubſtances, without its eroding acrimony. This ſoap therefore diluted, or rather diſſolved in the humours of the ſtomach and viſcera, is almoſt an univerſal deobſtruent, effecting thoſe things with ſafety, which more acrid diſſolvents could not do without danger.

The moſt efficacious ſoaps are made artificially, by uniting a very pure and attenuated vegetable oil, with an adulterated fixed or volatile alcaline ſalt, Thus alcohol of wine unites with a volatile alcaline ſalt into a wonderful ſoap, called by the name of *Offa Helmontiana*. The ſame alcohol, when freed from all its water, makes a true ſoap, when incorporated with a fixed alcaline ſalt perfectly dried by the fire. The æthereal oil of turpentine, when it is united, though not without difficulty, with an alcaline ſalt, yields a moſt excellent ſoap called *Starkeyan*. The more pure and ſubtle the oil and the ſalt are, of ſo much the more excellent uſe is the ſoap, which is made from them,

Fuliginous.] Smoke, as it riſes up from an open fire, is received and condenſed in the chimney, and ſticks to the ſides in black flakes; this is a true volatile coal enriched with a volatile fat oil, called ſoot. Its chemical analyſis into water, ſalts, oils, and earth, ſhews its ſoapy nature. Pills of ſoot gilt over to prevent their giving offence in viſcid diſeaſes, have often done great ſervice from their ſoapy attenuant nature.

Bile.] It is a true native ſoap formed in an animal body. Soon after the crude aliment has begun to be digeſted in the ſtomach, this is thrown in upon it in order to render the whole one uniform maſs, and make it diſſolvable in water. This is ſo well known, that ſilk-ſcowerers make uſe of it to clean their ſilks of their greaſy ſpots.

The painters dilute their fine colours with bile to make them ſpread the more equally. But its diſſolving power is moſt viſibly ſeen in thoſe diſeaſes, where by being hindered from paſſing in its uſual courſes it regurgitates backward into the blood, for then it turns it all to water; and for this reaſon it is, that a long jaundice is almoſt conſtantly followed by a dropſy. Bile is kept in the ſhops inſpiſſated into an extract to prevent its putrefaction, and is given in pills. This inſpiſſated bile, if it be rubbed on the ſwoln bellies of children, will diſſolve the concretions formed in the inteſtines, and carry them off by ſtool.

According to the different nature of the diſeaſe we uſe a different ſoap. The Venetian ſoap, as it is called, which is made of very pure expreſſed oil and a genuine alcaline ſalt, liquifies all the humours without any commotion; but in acute and putrid diſeaſes it is not quite ſafe to give it; in this caſe honey, ſugar, the freſh or inſpiſſated juices of the ſummer fruits, are to be preferred; eſpecially if we intend to reſolve an inflammatory thick matter. If cold, inactivity, or a mucous diſpoſition prevail in the humours, the acrid ſooty ſoaps, or thoſe made of the diſtilled aromatick oils and volatile alcaline ſalt, ſuch as the *ſales oleoſi volatiles* of the ſhops, are to be preferred; as alſo thoſe that are made of alcohol and fixed alcaline ſalt, *&c.* But where there is any putrefaction either preſent or expected, there we forbear to make uſe of bile, as it is ſo apt to putrify.

4. Mercurial preparations.] Quickſilver is ſo called, becauſe it ſhines like ſilver, and trembles as if it were alive. Whence Dioſcorides called it ὑδράργυρον,

and Ariſtotle ἄργυρον κίνητον, moveable ſilver. The Antients were acquainted with it, but condemned it as poiſonous. Dioſcorides (*g*) ſaid, that quickſilver when drank wrought the ſame miſchief as litharge, which he had before deſcribed (*h*); and elſewhere (*i*) he adviſes, that it be kept in glaſs, or lead, or tin, or ſilver veſſels, for it eats through and deſtroys all others; it has alſo a poiſonous power when drank, and erodes the inward parts by its gravity. Pliny alſo condemns it (*k*), calling it *vomicam liquoris æterni*, the poiſon of all things; ſaying, that it eats and breaks through the veſſels, ſpreading its peſtiferous venom: and hence afterwards he condemns the uſe of *minium* (*l*), from which quickſilver is got by boiling, as a raſh practice. Galen (*m*), in a ſhort diſcourſe on quickſilver, ſays, that he had no experience of its deadly qualities when drank, nor whether it was alike fatal when externally applied. And in the like manner the uſe of quickſilver was prohibited even by the later Greek Phyſicians. The Arabians were the firſt that began to uſe it externally in cutaneous diſeaſes. Afterward it was commended, but only externally, in venereal diſorders, 'till John de Vigo firſt gave red precipitate inwardly. Afterward they gave it in its native form in the pills called *Barbaroſſa*; as the celebrated Aſtruc has fully ſhewn in that compleat treatiſe he has wrote of venereal diſeaſes (*n*).

This wonderful metallick fluid, which is the heavieſt of all metals except gold, is alſo the moſt ſimple and moſt eaſily diviſible, ſince at the fire it all flies away in a volatile ſmoke; and how much muſt its ſurface be increaſed in reſpect of its ſolid bulk, before ſo very ponderous a metal can be ſuſtained by the air. It has farther no ſenſible acrimony, for it may be put into the moſt tender eye or a freſh wound without gi-

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(*g*) Lib. VI. cap. 28. (*h*) Ibid. cap. 27. (*i*) Lib. V. cap. 110. (*k*) Lib. XXXIII. cap. 6. (*l*) Ibid. cap. 8. (*m*) Lib. IX. Simplic. Medicament. Charter. Tom. XIII. pag. 270. [*n*] Pag 126, &c.

ving any pain. Yet this ſeemingly bland inert medicine, if applied to the body by liniments or plaſters, &c. or received by the pores in the form of a vapour or ſwallowed in ſmall and frequent doſes, changes the whole body in the moſt extraordinary manner, liquifies and diſſolves all the blood into a kind of fetid colluvies, and then carries it off by ſalivation, or ſometimes by ſtool.

In this caſe there firſt comes on an univerſal ſickneſs, a greater heat than uſual, a fever; the ſtrength in a manner begins to fail, the appetite to decay; this is followed by a violent thirſt, with a cadaverous ſmell iſſuing from the mouth; the gums, tongue, palate, tonſils, ſublingual, and other neighbouring glands, begin to ſwell and grow hot and painful; the teeth riſe, the tongue is eroded with white and painful ulcers, eſpecially about the ſides and tip, where it is contiguous to the teeth; the inner part of the cheeks and lips is affected in the ſame way; the whole face ſwells, and the lips, as they grow big, turn back in a frightful manner; and then a ſtinking viſcous humour runs out oftentimes in a vaſt quantity, exulcerating every place it paſſes by. This laſts for ſeveral days; and when by degrees all the forementioned ſymptoms abate, the whole body appears exhauſted and pale. Though in ſome, either by their taking cold, and ſo ſtopping the ſalivation in the beginning, or by a particular idioſyncraſy, the virtue of the remedy falls upon the ſtomach and inteſtines; and then theſe parts ſuffer the ſame effects as we ſee to ariſe to in the mouth. In this caſe the patient complains of moſt cruel and tormenting pains in the ſtomach and bowels, attended with a large diſcharge of thin watery ſtools, which are extremly fetid, and often by ſinking the ſpirits at once bring on fainting-fits, and ſometimes prove fatal.

This is at leaſt certain, that quickſilver diſſolves, attenuates, divides all the humours, whether they paſs off by ſalivation or ſtool. For we have known a very healthy fat man, by unwarily anointing his ſkin with a quickſilver ointment to cure the itch, to have fallen into a very violent ſalivation, which has laſted for twenty days, and when he has come out of it, he has been quite pale and lean; the blood being by this means diſſolved, and the fat all attenuated and carried off.

Pitcairn (*o*), who deduced ſo many beautiful inferences from the common laws of all bodies, was of opinion, that the weight of quickſilver alone was ſufficient to account for theſe wonderful effects: nay he boldly adds, that if gold could be reduced into ſuch a form as to mix with the blood, its powers would be proportional to its weight, and that it would exceed all other medicines as much in virtue as it does in weight.

For as quickſilver is diviſible into very minute particles, and is almoſt fourteen times heavier than the blood, when it has entered the veins, paſſes through the lungs, and is projected from the left ventricle of the heart with the blood into the arteries, it will have the ſame celerity with the other particles of the blood; and the quantity of motion in a particle of quickſilver, will be to the quantity of motion in a particle of blood, as the weight of the quickſilver is to the weight of the blood. The particles of quickſilver then acting with ſuch a force on the particles of the blood, will divide and attenuate them; and theſe being diſſolved will loſe all their redneſs; the ſalts and oils being in like manner attenuated will be ſet free, whence will ariſe the ſtink and putrefaction; and the attenuated humours will paſs out through the mouths of the veſſels that are dilated by the force of the quickſilver thus acting upon them with ſo great violence. And all theſe ſymptoms muſt of courſe be continually increaſing, as the particles of the quickſilver will retain the motion impreſſed upon them a con-

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(*o*) Diſſertatio de cauſis diverſæ molis, qua fluit ſanguis per pulmonem, natis & non natis, pag. 37, 38.

a conſiderable time; it being demonſtrable, that the retardation of equal bodies of different denſity, moving in the ſame liquid with equal velocity, will be in an inverſe proportion to their denſities.

This ſimple explication of the wonderful effects of quickſilver from its known gravity has been eſteemed by many ſufficient. And yet when I conſider of this matter ſeriouſly, I find ſome doubts to ariſe in myſelf concerning it, which I will here lay before the reader, not through any inclination to find fault with the gentlemen, whom I highly honour, but merely out of the regard I bear to truth, and a ſincere deſire of being better informed, in caſe I am in the wrong.

From theſe general properties of quickſilver it does not ſeem poſſible to explain clearly, why the humours, when they are diſſolved, ſhould rather paſs off by the ſalivating ducts, than by any other parts of the body.

The mercurial preparations of the ſhops produce all the ſame effects when given in a ſmall doſe, as are wrought by a much greater quantity of crude quickſilver. And is it likely, that the quickſilver ſhould be ſeparated in the body from its other parts, ſo as to recover its native form and original weight, when this cannot be done by art but by a ſtrong fire, and with the addition of ſuch other materials as ſhall very powerfully attract the acid that is united to the quickſilver? And though it ſhould be granted, that the quickſilver might again reſume its form when in the body; yet what reaſon can be given, why a few grains ſhould do that which a whole ounce of crude quickſilver is ſcarce able to perform?

To this difficulty I know it may be replied, that the particles of quickſilver, when divided moſt minutely, and ſtuck full of ſaline darts, may ſo much the more attenuate whatever it meets with, by having the moſt concentrated acid united to ſo weighty a metal. But let it be conſidered, that in making the white precipitate of the ſhops, which is the lighteſt of all the mercurial preparations, the quickſilver, that was diſſolved in the ſpirit of nitre, is thrown out by a ſolution of ſea ſalt poured upon it, and the powder that remains behind is by repeated edulcorations left almoſt inſipid and mild. And yet by giving twenty grains of this or leſs in divided doſes, I have often ſeen a violent ſalivation raiſed. Now the lightneſs of this precipitate, and the ſmall acrimony of the ſalts, that are united to the quickſilver in this powder, ſeem to oppoſe this opinion.

A perſon of diſtinction labouring under a confirmed weakneſs of ſight in both eyes, was ordered, by a quack, to ſnuff up two grains of a powder, which he afterwards owned was turbith mineral, and was immediately ſeized with a vomiting, ſweating, and purging, with a large diſcharge of urine, as alſo of an humour from his mouth and his eyes, which laſted for ten or twelve hours, ſo that his head was very much ſwollen: however, on the third or fourth day his ſight returned by degrees, and within a philoſophical month became more acute than ever, as you have the ſtory in Mr. Boyle (*b*).

Now from this relation it appears, that all the effects of quickſilver may ariſe from a little mercurial powder, touching only the inſide of the noſtrils.

Pure quickſilver, contained in a dry clean glaſs veſſel, by mere mechanical ſhaking only, yielded a ſoft black, very fine powder, of an acrid metallick taſte, ſomething like braſs. Quickſilver rendered perfectly pure by ſixty-one diſtillations, yielded a larger quantity of the like powder. Quickſilver expoſed to 180 degrees of heat for many months in conical glaſs cucurbits with a flat bottom, cloſed with a chemical glaſs phial inverted, yielded a like powder in every reſpect.

But this powder diſtilled with a ſtrong fire out of a glaſs retort returns to quickſilver again, except a few grains only of fixed matter.

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(*b*) De Utilitate Philoſ. Experiment. pag. 346, 347.

By the ſimple diſtillation of quickſilver out of a clean glaſs retort was produced a red ſhining powder, eaſily friable, of a very acrid, metallick, nauſeous, penetrating taſte, very difficult to be got out of the mouth, capable of throwing the whole human frame into diſorder for a conſiderable time, and diſpoſing it to excretions: yet this powder in a violent fire was almoſt wholly changed into quickſilver again (q).

Hence it appears, that quickſilver, without any addition, by attrition only, or the action of the fire, may accquire a very acrid quality; and by a greater fire loſing all acrimony, it will re-aſſume its old form again. Does then its efficacy depend on the common properties of all bodies? Or rather ſhould we not aſcribe it to its own ſingular nature, which is to be known only by experiments? In the mean time it may ſuffice for the Phyſician to know its effects when applied to the body, though he knows not the particular manner whereby it acts. The virtue of other remedies is no leſs obſcure to the enquirer: for who has ever explained the manner by which ſcammony carries off the blood by ſtool after it is converted into a putrid water? Whoever has throughly underſtood the wonderful properties of antimony and its ſeveral preparations, *&c*?

All the remedies here recited ſhould be directed as much as poſſible to the places where the obſtruction is formed: by ſuch applications as are derivative, attractive, and propellent; of which we have treated in the preceding paragraph.

## SECT. CXXXVI.

THE coagulating cauſe is drawn out by the attraction of another body that is ſtill more attractive. Thus acids are attracted into alcalies, and oils into alcalies, *&c*. this is chiefly to be diſcovered by chemical experiments.

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(q) H. Boërhaave de Mercurio in tranſact. Philoſoph. Anglicanis, No. 430. Menſ. Novemb. & Decemb. An. 1733.

It appears by chemical experiments, that ſome bodies have this property of attracting and uniting with other bodies; *v. g.* if one drachm of oil of vitriol be diluted with three pints of water, and oil of tartar *per deliquium* be then poured on it, it will unite with the acid of the vitriol, and form with it into a compoſite ſalt. If quickſilver be dropped by degrees into melted ſulphur, and incorporated with it by continual ſtirring, theſe two will unite together into a black maſs, which, though it be expoſed to the action of a ſtrong fire, will neither revert to the quickſilver again nor fly off, but will both be ſublimed together and form cinnabar. In this caſe, if you would make the quickſilver ſeparate aud become fluid again, you muſt add ſuch a body to this concreted maſs of ſulphur and quickſilver, as ſhall more powerfully attract the ſulphur and unite with it, and then you ſhall have your quickſilver pure as before. This is done by mixing filings of ſteel with the cinnabar, and ſetting it over a ſtrong fire in a retort, for the ſulphur will in this caſe unite with the ſteel, and the quickſilver being ſet free will paſs into the receiver.

Many other experiments might be produced to ſhew, that bodies, when united together, are capable of being disjoined by the admixture of another body, which ſhall attract the particles of one of them more than they attract each other. Thus ſilver diſſolved in *aqua fortis* is precipitated by adding copper; and the diſſolved copper will be precipitated in like manner by an addition of ſteel, *&c.* Alcohol diſſolves and unites with diſtilled oils; pour water on them, and the fluid that was before limpid will turn milky, and by degrees the oils, that were before incorporated, will ſeparate.

The great difficulty here is, that the coagulating cauſes are not ſo eaſily diſcovered; and that the coagulation of our humours may ariſe from quite oppoſite cauſes. Do not reſt and too much motion both coagulate the blood? Do not the greateſt cold and burning heat convert its elementary particles into irreſoluble maſſes? Who can explain the manner how a ſchirrhus ſhould ſuddenly ariſe from a great fright, which yet I have ſeen, and which never after could be reſolved by the application of any remedy? Beſides, when our humours have been once concreted by a coagulating cauſe, it often changes them in ſuch a manner, that they will not recover their former fluidity, though the coagulating cauſe be taken away. If any one doubt of this, let him try if he can make the blood fluid again by adding alcalies to it, which has once being coagulated by oil of vitriol.

However we have one fair inſtance, that the reſolution of coagulated humours may be performed by educing the coagulating cauſe, and the fluidity ſo far reſtored, as to have the humours paſs freely again through their reſpective veſſels; when the extremities of the body are deprived of all vital influx of the humours by an extreme froſt; if then the part be covered with ſnow, or immerſed in very cold water, only not cold enough to be frozen, the icy ſpicula will by this means be drawn out, life will return to the part, and the concreted fluids recover their former fluidity.

Many other reſembling caſes may lie hid perhaps in nature, wherein the concretions formed in our humours might poſſibly be diſſolved by educing the coagulating cauſe. The elements of the ſtone are contained in the moſt limpid urine of an healthy man; theſe when they are united cohere ſo as not to be reſolved by any art. Whoever therefore could take away the power, whatſoever it be, that unites them, would diſſolve the ſtone. In the mean time it is not a rule, that a great acrimony muſt always be joined to a great reſolving power: ſoft oil will diſſolve wax, which will not yield to *aqua fortis*; the unactive white of a boiled egg will liquefy myrrh, which is ſo tenacious, that it can hardly be diſſolved by any other menſtruum. The very great uſefulneſs of ſuch remedies,

medies, when they are found, make them well worth ſearching after.

## SECT. CXXXVII.

BUT when the liquid is driven into wrong veſſels, that it cannot paſs through, and by this means creates obſtructions, numerous and malignant diſeaſes are produced, ſo that this caſe deſerves well to be attentively conſidered.

The cauſe of an obſtruction here mentioned is that which was explained in §. 118. where, namely, the cauſe of the obſtruction neither reſides in the contraction of the veſſels, nor in the concretion of the liquids, but proceeds merely from the liquids being admitted into leſſer canals, than ſuch as naturally they ought to paſs through: ſo that though ſuch liquids may enter the dilated orifices of the leſſer veſſels, yet can they not paſs through their narrow extremities, and conſequently will ſtick by the way, and ſtop up the veſſels.

What a plentiful ſource of diſeaſes this is, will appear, if we conſider, that perfect health depends on the due circulation of the humours through veſſels of a proportional ſize; and that this diſeaſe preſently follows upon an increaſe of velocity in the circulating fluid. For if this velocity be increaſed by violent muſcular motion, or a fever, we preſently ſee many parts of the body grow red which were not red before, which ſhews that the red blood has entered the veſſels where naturally it was not to be found before.

And not only numerous diſeaſes, but ſuch as are moſt dangerous too, may ariſe from hence. For it is eaſily conceived, that in the ſame manner as a red particle of blood enters a ſerous veſſel, ſo may the other fludis of ſmaller ſize be impelled into foreign veſſels by the ſame cauſes. And ſhould an obſtruction happen from ſuch cauſes in the very tender veſſels of the cerebrum and cerebellum, on which life and humanity depend, this would occaſion many mortal diſeaſes to ſpring up of a ſudden, and yet the cauſes of them might be altogether indiſcernible in the dead body. Such diſeaſes are juſtly called malignant.

It is plain therefore of what uſe it is to underſtand aright the nature and cure of this diſeaſe.

## SECT. CXXXVIII.

WE know this to be the caſe, if we know, 1. that its cauſes, which for the moſt part are very diſcernible, have preceded; 2. that cauſes directly oppoſite to theſe have immediately ſucceeded; 3, and when the effects of it are plain to be ſeen (120, 121, 122).

Our preſent enquiry is, how we may certainly know that this is the cauſe of the obſtruction.

1. In §. 118. the cauſes are ſet down which have been found to produce an *error of place.* Theſe were a plethora, an increaſe of motion, the rarefaction of the liquid, and the relaxation of the veſſel. A plethora is known by what has been ſaid in §. 106. ε. An increaſe of motion is indicated by the ſymptoms mentioned §. 101. The rarefaction of the liquid is learnt from what we have obſerved in §. 106. δ. And we may eaſily find out when the veſſel is relaxed by the circumſtances recited in §. 27. and §. 43. and §. 44. But more eſpecially, if an error of place be obſerved to occur without any ſigns of a plethora, an increaſe of motion, or of rarefaction, we may then fairly impute it to the relaxation of the veſſels alone. For the mouths of the leſſer veſſels muſt of neceſſity be dilated, before they can receive a groſſer humour, than ſuch as before was wont to paſs through them, as the narrowneſs, which is natural to theſe veſſels, neceſſarily excludes all groſſer humours. But this dilatation of the veſſels muſt ariſe either from an in-

creaſe of the force by which the humours are impelled into the veſſels, or from a diminution of the ſtrength of the veſſels, by which they reſiſt too great a dilatation. When therefore the cauſes do not ſubſiſt, by which the fluids act with a greater force againſt the ſides of the veſſels, an *error of place* can only ariſe from the leſs reſiſtance of the ſides of the veſſels, that is, from their being too much relaxed. And this is the cauſe, which very frequently occurs; for it is merely from the too great laxity of the veſſels, that ſome people are ſo ſubject to ophthalmies, which though not very ſharp, are notwithſtanding very laſting. Thus, at the approach of death, when the vital ſtrength is decayed, we obſerve a viſcid ſweat to be expreſſed, attended with red, purple, and livid ſpots, ariſing from the admiſſion which is given to the thicker liquids by the leſſer veſſels, and the reſolution of the ſmall ſphincters, wherewith they ſeem to keep in the humours, which they contain.

2. If now ſuch applications be made to the veſſels that are dilated by a plethora, an increaſe of motion, or the rarefaction of the liquids, as ſhall ſuddenly contract the capacity of the veſſels, we are ſure that an *error of place* will certainly occur; for the thicker humours, that have entered the dilated veſſels, are kept in by their being contracted, ſo that they can neither be driven backward nor puſhed forward through their narrower parts; from whence an obſtruction muſt neceſſarily follow. If after hard labour a man cover himſelf up cloſe, and ſo take reſt, all the veſſels contracting gradually will by their own ſtrength drive back the foreign humours, which have entered into them; but if the ſame perſon were to expoſe his naked body to the cold wind, a ſevere pleuriſy might ariſe from it, with other inflammatory and difficult diſeaſes.

3. This diagnoſis is confirmed, when the other changes are obſerved in the diſordered functions, which have been deſcribed in the numbers cited.

## SECT. CXXXIX.

IT is alſo eaſy to foreſee what will be the conſequence of this diſorder, by what has been explained in (120, 122, 123).

When this diſorder is once known to ſubſiſt, and it is likewiſe known from what cauſe it has aroſe, and in what part of the body it is fixed, it will be eaſy to foretel the effects which will follow from it. For there is far more to fear from an *error of place* ariſing from too great a velocity in the circulating humours, than from the ſame circumſtance when it proceeds only from too great a laxity of the veſſels: an *error of place* in the veſſels of the brain, will be far more dangerous than in the external integuments of the arm, *&c.* But theſe particulars have been fully explained in the number referred to. For in §. 120. the general effects of all obſtructions have been conſidered, and in the following §. 121, 122, 123, it has been alſo explained, what dangers were to be apprehended from this diſorder, when formed in the ſeveral ſeries of veſſels, and in the different parts of the body.

## SECT. CXL.

THE cure is wrought, 1, by driving the obſtructing matter backward by a retrograde motion into the larger veſſels; 2. by reſolving it; 3. by relaxing the veſſel; 4. by bringing the matter to a ſuppuration.

The obſtructing maſs is fixed in a conical veſſel, which is continually growing narrower; ſo long therefore as the bulk of this maſs ſhall remain the ſame, and the ſides of the obſtructed veſſel retain the ſame degree of firmneſs, the obſtacle cannot poſſibly be thruſt any farther forwards into the narrower parts;

nothing therefore is left but to puſh it backwards by a retrograde motion towards the baſis of the conical veſſel, that thus it may paſs again into the larger veſſels. But from the obſervation of Leeuwenhoeck, mentioned §. 131. numb. 1. it is plain, that the obſtructing maſs would in this caſe be often puſhed back, and again thruſt forwards, and thus continue moving for ſome time in the obſtructing canal; and that the cauſe protruding it into the narrower part is the impetus of the fluid preſſing upon it from behind, which, when it ceaſes, gives place to the contractile force of the ſides of the obſtructed canal to drive it back towards a broader place.

That ſuch a retrograde motion of the fluids takes place in the veſſels, as ſoon as the impelling force of the heart ceaſes, or is diminiſhed, is plain from the moſt certain obſervations. When a perſon falls into a ſyncope, the action of the heart begins to be diminiſhed; and in caſe it be a perfect ſyncope, abſolutely ceaſes. Immediately the lips and eyes begin to turn pale, the face to fall and be contracted, the ſmaller veſſels collapſing, or rather contracting by the elaſticity of their ſides, and puſhing back the fluids they contained into the larger veſſels.

Suppoſe now, for inſtance, that a red globule, which has entered the orifice of a dilated ſerous artery, be ſo fixed there as it can paſs no farther; if this very globule be puſhed back into the artery charged with red blood, from whence this ſerous artery was derived, it will freely paſs through the extremities of the red artery, and the obſtruction will be removed. And the like removal of an obſtruction may be wrought in the other ſeries of decreaſing veſſels.

2. By the definition given in §. 107, an obſtruction was ſaid to ariſe from the bulk of the matter that was to paſs, exceeding the capacity of the veſſel that was to tranſmit. If then the obſtructing matter could be ſo divided, as to be made capable of paſſing through the narroweſt part of the obſtructed veſſel,

the obſtruction would be taken away. This method of reſolving an obſtruction was viſible in the experiment of Leeuenhoeck already recited, where the obſtructing maſs by going backward and forward and rubbing continually againſt the ſides of the canal was ſo diſſolved, as to become capable of paſſing through it.

3. It is very evident, that the ſame effect altogether will be produced, whether the capacity of the obſtructed veſſel be increaſed, or the bulk of the obſtructing maſs be leſſened; for in both caſes a free paſſage will be obtained for the fluid, that was to be tranſmitted through the canal that was before obſtructed, which was the thing required. And that the veſſels may be ſo relaxed, as not only to admit the groſſer humours, but alſo to tranſmit them through their extremities, is what we learn from daily experience. The mouths of the open veſſels which line the inſide of the womb, tranſmit only a thin liquid reſembling dew, at all times when the woman is free from her menſtrual diſcharge; but when ſhe has her menſes, they let fall a red blood; and when theſe ceaſe, they are again contracted, and give no admiſſion to the red blood any longer. It is a common circumſtance with many perſons, if they be roughly carried over rugged and ſtony ways, to void pure blood inſtead of urine, without any pain, not from any rupture, but merely from a dilatation of the *tubuli renales*; and this diſorder is cured only by ſitting ſtill, and giving time to theſe tubes to contract, which before were too much dilated.

It may perhaps ſeem ſtrange, that in §. 118, the relaxation of the veſſels ſhould be reckoned among the cauſes, which gave admittance to the groſſer humours into foreign veſſels; and yet here the like relaxation of the veſſels ſhould be recommended in the cure of the ſame diſorder. But we ſhould do well to conſider, that the relaxation of the veſſels, which cauſes the groſſer humours to be admitted into the dilated orifices of the veſſels, and not tranſmitted, is the cauſe of an *error of place;* but that ſuch a relaxation, as cauſes the groſſer liquids that are admitted to paſs through the extremities of the veſſels, will cure the obſtruction that an *error of place* has cauſed.

4. But now when the obſtructing maſs is ſo firmly fixed in the narrow part of the connivent veſſel, that it can neither be puſhed backward into the greater veſſels, nor be reſolved by art; and farther, when the obſtructed veſſel cannot be ſo far relaxed, as to ſuffer the offending matter to paſs through it, the only thing left is, that the obſtructed part be cut off by the vital power, which preſſes upon the obſtructed place from behind; the veſſel thus freed, but open, pours out its humours, which mixing with the very tender parts that are cut off, partly by the heat of the place, and partly by the attrition of the neighbouring veſſels, form all together an homogeneous, white, thick, fat humour, called *pus;* and this we call bringing the matter to a *ſuppuration.* This is the only way, by which nature diſcharges itſelf of every part, that is ſo obſtructed as not to be reſolved. And this operation of nature is always ſalutary, provided the veſſels that are thus to be changed into *pus,* together with the unpaſſable liquid obſtructed in them, are not abſolutely neceſſary to life, and that the *pus* thus formed may be commodiouſly carried off.

When in the moſt ardent of all fevers, the plague, a terrible inflammation, attended with ſo hard a tumour as no art can reſolve, ſhall ariſe about the axillary or even inguinal glands, by a ſuppuration about the edges, the whole that is mortified ſhall be ſeparated from the parts which have life, and fall off, which could never be effected by any art but by ſuppuration only.

## SECT. CXLI.

THE obſtructed matter is thrown back again, 1. by an evacuation of the liquid, which preſſes upon it, by large and ſudden bleeding, whence it is driven back by the action of the contracted veſſel; 2. by frictions directed from the extremities of the veſſel towards its baſis.

1. When an artery, that has been diſtended by the action of the heart, contracts itſelf, it would preſs back the fluid it contains into a broader place, unleſs prevented by the impetus of the liquid, which preſſes upon it from behind; when therefore the quantity of that liquid is diminiſhed, and the force preſſing from behind is weakened, the fluid contained in the arteries will be moved with a retrograde motion from the apex towards their baſe; and thus, ſo far as concerns the direction of the courſe of the fluid, the arteries for a time will be converted into veins. Now theſe effects are both wrought by bleeding, for it both leſſens the quantity of blood contained in the veſſels, and weakens the force of the impelling heart; for if we pleaſe we may weaken by bleeding 'till we kill the man.

But that theſe effects may be wrought to advantage, it will be adviſeable to bleed both largely and ſuddenly; for if a ſmall portion of blood only be taken away, the quantity will not be ſufficiently leſſened; and unleſs it be done ſuddenly, the force of the heart preſſing upon the blood from behind will not be weakened to a proper degree. For a ſtrong man will be ſcarce able to bear the loſs of two pounds of blood, if let out from the vein in a full ſtream, without fainting; whereas, if it fall drop by drop from the noſe, or as it ſometimes happens upon pulling out a tooth, if for whole nights and days it ſhall keep oozing out of a ſmall artery, he ſhall bear the loſs of three times the quantity and not faint at all.

This we have confirmed to us by the circumſtances, which have been obſerved to occur in acute inflammatory diſeaſes. A perſon ſick of the pleuriſy cannot draw in his breath, it gives him ſuch exceſſive pain, and thus he is well nigh ſuffocated; open a vein in the arm, and you carry off the diſorder; even whilſt the blood is flowing out the pain frequently begins to grow leſs, and ſometimes entirely ceaſes, the obſtructed veſſels being freed from the load which oppreſſed them by a retrograde motion of the humours towards the broader veſſels. When the eyes are inflamed and look red all over, from the blood which is impelled into improper veſſels, if you bleed largely, even to fainting, the redneſs ſhall immediately go off, by reaſon that the blood is puſhed back into the larger veſſels. For it is by no means requiſite, that the obſtructing maſſes ſhould be carried a great way backward by this retrograde motion, before they enter the larger trunks; ſince we learn from anatomical injections, that very frequent anaſtomoſes and divarications of the trunks into branches, are often found to lie within a very narrow compaſs.

The antient Phyſicians, though unacquainted with the circulation of the blood, have yet from the bare obſervation of effects in diſeaſes, recommended the free uſe of bleeding in reſembling diſorders. Galen, in his explanation of the twenty-third Aphoriſm, §. 1. (*a*) commends ſuch an evacuation "in very ardent fevers, "in very great inflammations, and in exceſſive pains," *in febribus ardentiſſimis, in maximis inflammationibus, & vehementiſſimis doloribus*. And in another place (*b*), "where there is too great an abundance of over-"heated blood, giving riſe to a very acute fever, it is "convenient to make a ſudden and large evacuation; "we muſt even attempt an inanition, 'till the patient "is ready to faint away, regard being always had at "the ſame time to his ſtrength;" *ubi ferveſcentis ſanguinis ineſt plenitudo, acutiſſimam accendens febrim, ſubito ac ſimul evacuare expedit, eamque inanire tentandum, vel ad animi deliquium uſque, virium modo inſpecto robore*. What follows after ſhews plainly, that Galen is here ſpeaking of bleeding, for he directs the Phyſician

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(*a*) Galen. Comment. I. in Aphoriſm. Hippoc. Charter. Tom. IX. pag. 40. (*b*) De curandi ratione per venæ ſectionem, cap. 12. Charter. Tom. X. pag. 441, 442.

ſician to attend to the ſinking of the pulſe, by clapping his finger upon the artery, whilſt his patient is bleeding, leſt he ſhould fall into an irrecoverable ſyncope; which accident, he ſays, happened to three Phyſicians to their great diſgrace.

But the ſymptoms of an approaching ſyncope, from a large diſcharge of blood, are very viſible; for the pulſe becomes leſs ſtrong and more fluttering, the head grows giddy, the eyes and lips turn pale, the ſtomach is uneaſy, and diſpoſed to give up its contents, and the blood itſelf flows out of the veſſel with leſs celerity; when therefore theſe circumſtances occur, it will be right to abſtain from any farther evacuation.

2. When the impetus of the liquid, preſſing upon the obſtructing maſs from behind, is removed, or at leaſt very much diminiſhed, the contraction of the veſſel only then drives back the obſtructed matter towards a broader place. Whatever therefore ſhall increaſe the contractile force of the veſſels, or conſpire with it in producing a like effect, will alſo aſſiſt in promoting this retrograde motion. Now friction, by compreſſing the ſides of the veſſels, does the ſame thing as their own contractile force had done, and even adds to the efficacy of the ſaid contractile power, as has been ſhewn §. 28. numb. 2. and conſequently cannot but be uſeful in this caſe, eſpecially if it be directed from the extremities of the veſſel towards its baſis.

The advantage of this practice is farther confirmed by experience. For bleeding will ſucceed better in a pleuriſy, if the ſide affected be gently rubbed at the ſame time as the blood is flowing from the vein; or if the patient move the affected part by frequently drawing in his breath as hard as he can, or by coughing; for which reaſon it is not unuſual to provoke to a fit of coughing by a little warm wine, or by holding vinegar under the noſe, under a pretence of keeping up the ſpirits, that by this means the ſick may do that undeſignedly, which through fear of increaſing their pain they could not otherwiſe be prevailed on to conſent to. When animals have been hard hunted, upon taking off their ſkin, the whole *panniculus adipoſus*, and even the muſcular fleſh, has been found to be turned almoſt black, from the blood being thrown into veſſels which did not properly belong to it; ſo grooms rub down their horſes in the ſtable after they have been rode hard, in order to prevent this inconvenience; having learnt by experience, that unleſs they do this, their cattle will grow faint and become altogether unfit for the diſcharge of their uſual exerciſe.

It was cuſtomary with the Antients to adviſe the uſe of baths and frictions after a long journey; and this cuſtom ſtill prevails in Aſia.

## SECT. CXLII.

THE obſtructed matter is reſolved by ſuch remedies, as are mentioned in 133, 134, 135, 136.

Theſe have all been treated of in the numbers referred to. It is very remarkable, that though our blood ſpontaneouſly coagulates when at reſt, yet it ſhall gradually again turn to a fluid. For the blood let out of the vein of a very healthful man, ſhall preſently be converted into a ſolid cake; from whence by degrees a thinner ſerum ſhall ſeparate, leaving the concreted red maſs, by ſome called the iſland, to ſwim within it. Pour off all this ſerum, and the red thick part ſhall in a few hours yield a reſembling ſerum a ſecond time, and ſo on 'till the whole ſubſtance ſhall in great meaſure be liquified. From whence it ſeems highly probable, that the obſtructing maſſes, which ſtick faſt in the veſſels may by degrees be diſſolved in like manner from the heat of the body, provided that the impetus of the fluid preſſing upon them from behind be diminiſhed, and there be not ſo great a firmneſs in the veſſels as ſhall condenſe the fluid too much.

## SECT. CXLIII.

THE veſſels are relaxed by the remedies recommended in 35, 36, 54.

## SECT. CXLIV.

THE buſineſs of ſuppuration will be treated of more largely under the ſubject of inflammation.

Thus have we explained the moſt ſimple diſeaſes, which are found to ſubſiſt in the ſolid parts of the human body, to wit, the too weak or too ſtrong coheſion of their particles to each other, without any conſideration of the fluids. We next proceeded to the fluids, and have conſidered the ſeveral diſorders to which they are ſpontaneouſly inclined. From hence we advanced to the moſt ſimple diſeaſes, which have been obſerved to occur in the ſolids and fluids taken together, ſuch as too quick or too ſlow a motion of the fluids through the veſſels, and to them we have farther added the effects of a plethora, or too great redundancy of good humours. And, laſtly, we have treated of an obſtruction, as it owes its original to ſomething amiſs in the ſolid or fluid parts, or in both together.

It now follows, according to the order ſet down in §. 16. that we treat of the coheſion of parts diſſolved, that is, of a wound. For every conſidering perſon will plainly ſee, that all theſe particulars were neceſſary to be premiſed, before the hiſtory and cure of a wound could be treated of in due manner.

The End of VOL. I.